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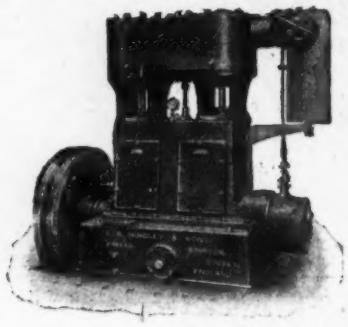

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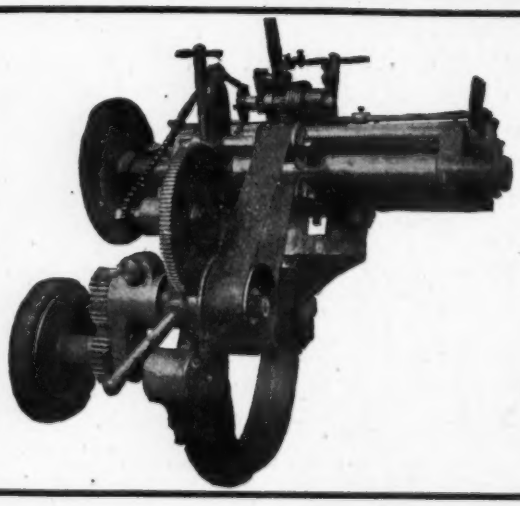

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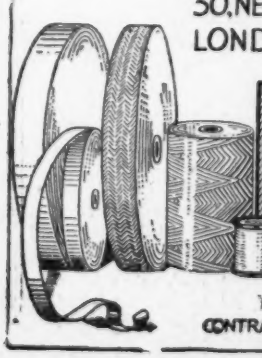

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ELECTRICAL REVIEW.

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THE REPORT ON POST-WAR TRADE.

THE Balfour Reports on Post-War Trade Policy, which are abstracted on another page of this issue, contain a number of interesting conclusions and recommendations. It is admitted that in certain branches of British manufacturing industry German control was becoming a serious matter when the declaration of war brought penetration plans to an end. During nearly four years that have elapsed since then the nation has learned many things concerning the growing enemy predominance which would probably have been described as incredible and untrue in the times of peace, when it was less easy to drag commercial penetration designs out before the public gaze in all their nakedness. Though our war aims are not to crush the German people, but to defeat for ever the monstrous influence which has misguided them, and brought them alienation from all the free peoples of the world, it will assuredly be the determination of Britain and her Allies that that policy of unscrupulous commercial domination shall never again be permitted. By what means are we going to prevent deplorable history from repeating itself? The Committee finds that the war conditions, for which we have to thank the enemy, have assisted us to a great extent by creating the necessity and the opportunity for strengthening places which had become weak in our industrial armour. But measures must be adopted to ensure that the experience gained, and the progress made, by us in so many directions during the war, shall not be thrown away when new relations are established between us and our present enemies, however chastened and democratised the latter may be when the end shall come. Whatever those measures may be we shall all agree with the Committee that they will be of little avail unless employers and employed can be brought to see the absolute demand of the situation for a united effort of all to attain the largest possible volume of production with maximum efficiency. We cannot be fully equal to the financial and economic strain within reasonable time unless as a nation we fully recognise and implicity obey that demand. The policy recommended by the Committee, of prohibiting the importation of goods of enemy origin, is already embodied in legislation which was passed some months ago. The Committee made the recommendation "subject to licence in exceptional cases." In addition, we and our Allies should adopt a policy of joint control of the export of certain important materials which will be required for the restoration of our industries, and the proposal that a joint organisation should be set up for dealing with Allied orders for reconstruction purposes seems to be a thoroughly sound one. In the conviction that State restrictions on industry should be removed at the earliest possible moment after peace, the Committee is in accord with the mind of business men who know too well the deadening effect of "control" upon initiative and enterprise. The Committee favours a "selective" rather than an exclusively "Empire" policy in respect of raw material resources, but the main purpose of such selection is one of the things upon which all are in agreement, namely, that we may ensure that the Empire in an emergency shall be independent, for its supply of any essential commodity, of any single foreign country or possible combination of countries. Of course, we must safeguard and foster

essential industries—there is not a dissentient voice to that proposition to-day. If there were it would be that of little less than a traitor or some poor fool who had forgotten all the risks that we ran during the early stages of the war through our former dependence upon enemy supplies of certain manufactures. If Lord Balfour's Committee's advice is adopted we shall rigorously exclude aliens from certain occupations—such as pilot and patent agent—we shall license foreign commercial travellers, watch the ownership of companies, and stringently "police" subjects of present enemy countries after the war.

We quoted in our last issue the Committee's recommendations respecting trade organisation, and closer combination among traders as a means of meeting increasing foreign competition, and those who have followed our statements on this subject will know how heartily we are in accord with the proposition that individualism must be supplemented by co-operation. "Every encouragement should be given by the Government to the formation of combinations of manufacturers and others concerned with securing supplies and materials," but in regard to production, "the constructive action must come from the industries themselves." The Committee considers it as a general rule undesirable that the State should attempt to provide capital for industrial purposes, and we believe that industry will find it more satisfactory to rely upon its own efforts and the efforts of private banking enterprise and the Trade Bank Corporation, than to look to the State, which would inevitably, it seems to us, have to impose such a measure and character of control as would not be welcomed. Nobody can tell at this stage of the war what the economic conditions dictated by the terms of Peace may be throughout the world; we have also nothing to guide us as to what will emerge from the next General Election, with its vastly increased and altered body of voters; but we commend the statement of the Committee on fiscal policy to our readers' careful attention. The hour has not yet struck for the profitable discussion of this great subject, but sooner or later it will come prominently before the nation, which, under the influence of war and war-time revelations, has developed some of its thinking. That pivotal industries must be maintained "at all hazards and at any expense"; that there must be safeguards for our producers against "dumping" and "sweated" imports, and preferential arrangements between ourselves and the Overseas Dominions and Possessions; and that everything possible should be done to promote trading relations between ourselves and our Allies and neutral countries—these, we feel, must be regarded by that part of the nation that really thinks about such matters, as perfectly sound proposals. It is suggested that an independent State Assistance Board should be set up to advise the Government upon claims for protective assistance for different industries and to frame proposals. There is little room for doubt that some such Board will be needed.

The Metric System.

In our "Notes" last week we gave extracts from the reports of Departmental Committees appointed to consider after-war trade, which show that the authors are opposed to the adoption of the metric system, and that their views are based on contradictory and largely erroneous impressions. Thus the Engineering Trades Committee states that manufacturers already use the metric system "without difficulty for their own convenience," while the Shipping Committee understands that all existing patterns, dies, jigs, gauges, &c., would become useless—a wholly mistaken idea. The former Committee says "there is no demand from the side of the manufacturer" for the adoption of the metric system; the latter states that a number of witnesses, as well as the majority of the firms replying to inquiries, expressed themselves in favour of the compulsory adoption of the metric system. The Shipping Committee, however, deliberately throws overboard this consensus of opinion, and gratuitously casts doubt on the mental capacity of the firms referred to. We are told that "in book-keeping and in the payment of wages, calculating machines now in use reduce the inconvenience of our monetary system, if any, to a minimum"; that "*if any*" is delicious—but what of the cost of these machines, and the number required, as compared with the cost and number of purely decimal machines to do the same work in a rational system of units? The decimal machines would be able to deal with metric weights and measures as well as money.

Again, the Engineering Committee advocates the abandonment of binary divisions of the inch in favour of the division into hundredths (*sic*—we thought it was thousandths) "which is already used exclusively for high-class work," while the Shipping Committee says that "in the works, feet, inches, and subdivisions of inches, *i.e.*, halves, quarters, eighths, sixteenths, thirty-seconds, are used without inconvenience." Further, the latter Committee goes out of its way, showing the clearest prejudice, to demur to the decimal subdivision of time and of the right angle, which are not proposed by anybody.

Even the Textile Trades Committee "found among individual witnesses a decided predisposition in favour of the metric system," but reports against it. Here again is the usual contradiction:—The Committee dwells on the confusion and inconvenience that would be caused by a change from the yard to the metre (*i.e.*, practically 10 per cent.), and goes on to say that, in point of fact, both exporters and manufacturers when trading with metric countries *do* quote and deliver goods in metric weights and measures, adding that a universal system of weights and measures would be a source of great convenience, and would facilitate international trade! Let us be thankful that this sapient and logical-minded Committee at least recommends the simplification of our units and the decimalisation of our money.

Turning to a still more important report—that of Lord Balfour's Committee—we observe, with great regret, that the majority of the signatories reject the proposal to adopt the metric system, giving reasons very similar to those mentioned above. For example, they advance as an objection the fact that "before the war more than half our export trade was with countries which do not use the metric system"; they fail to realise that this was the case in great part *because* WE *do not use it*—our trade ought not to have been so restricted. The same arguments as to the heavy cost of altering machines are put forward—but why should they be altered? An argument of the anti-metrists is cited in par. 285, that "for practical purposes binary divisions are better than decimal," but in par. 288 the Committee throws this overboard, stating that "we would also emphasise the advantages, already widely recognised, of using decimal subdivisions of our basic units"! Thus our opponents flounder in the mud of prejudice, catching at straws to save themselves from submersion, and were space available we could go on exposing their futilities. Their *non possumus* extends also to decimal coinage; we are pleased to note that they agree with us as to the necessity of retaining the pound sterling as the essential unit of value, and as to the convenience of decimal coinage, but they boggle at the slight change (4 per cent.) in the "value" of the penny—this at a time when the penny is worth about as much as a pre-war halfpenny, and penny postage is being abolished! We hope that Parliament will adopt a saner view of the situation.

TUBULAR EARTHS FOR LIGHTNING CONDUCTORS.

By KILLINGWORTH HEDGES.

There are several objections to the use of the plate form of earths. Although they may have been buried to a suitable depth in moist ground, their efficiency decreases as the soil dries away; the plate is then only in partial contact, and the resistance increases sometimes to such an extent as to insulate the ground connection.

A lightning-conductor installation is usually left to take care of itself. Theoretically, it should remain efficient for the life of the building; but, at any rate, it should be reliable for many years, so that it is very necessary to furnish it with a permanent ground connection having an unvaried resistance.

The entire system of protection may be rendered useless by a poor connection. The discharge must get to the ground water, or at least to wet soil. Dry earth is such a bad conductor that a case is mentioned in the *Bulletin* of the University of Missouri of a lightning stroke that was known to travel 900 ft. from the house that was struck, along a water pipe buried in dry soil, and damage a drinking fountain where the current was earthed.

The tubular earth, with its point driven firmly into the ground, does not lose efficiency by changes in the soil

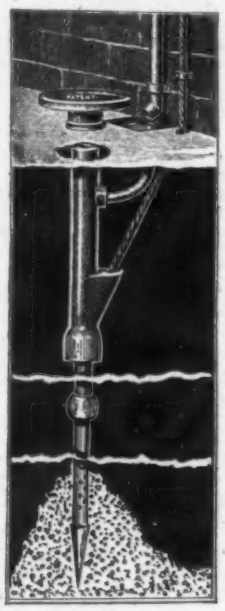


Fig. 1.

which are noticeable in the proximity of new buildings, due to drainage, and it has a constant resistance. Another important factor is its lower first cost, which, at the present time, is specially noticeable owing to the high price of copper and cost of labour for excavating the space for the plate earth.

Although pipes filled with water, with conductors attached and inserted, have from time to time been used for telegraph ground wires, it was in connection with the protection of St. Paul's Cathedral against lightning that the now well-known driven-tube plan was first installed by the writer, the early patterns being made up of built-up steam pipe, the conductor entering at the top. This method was discarded, as, after about five years, the tube was found to have badly deteriorated near the surface of the ground. The standard pattern, as shown by fig. 1, was then designed, using a cast-iron top piece, which is connected to the tube by set-screws (not shown in fig. 1). A leaden washer may be inserted between the tube and the cast-iron socket, to perfect the joint, and the tubes are driven with a sledge-hammer by means of the driving piece, fig. 2, which is screwed into a socket, taking care that it actually butts on the top of the tube.

A very large number of this pattern have been driven in all sorts of ground, including hard chalk, and have been specified for Admiralty contracts to be sunk to a depth of over 20 ft. In the writer's opinion, it is unnecessary to have a low resistance, if sufficient numbers of earth connections are installed. If moist earth is not reached at a convenient depth, the system of watering should be applied, either as shown in fig. 1, or by collecting surface moisture, as shown in fig. 3; a constant resistance of under 5 ohms is obtainable by watering, even in dry ground. A recent test of a large number of tubular earths, sunk by Messrs. W. T. Furse, of Nottingham, averaged 1 ohm each immediately after

Fig. 2.

driving. This low resistance is good, but, as stated, not really important. In another system of earths, it has been obtained artificially, by partly filling the tubes with rock salt; this has the objection of introducing a substance which in time will have a deleterious action on the connection to the tape or cable. Some of the tubular earths at Westminster Abbey were tested six years after they were installed, and their conductivity had improved; this was probably due to the granulated carbon which surrounds the conductor being packed tightly against the inside of the tube by the action of the water which trickles through.

A new method of making the joints between the conductor and the cast-iron top piece is by using lead yarn. This method enables the joint to be made quicker than with molten lead, and does away with the plumber's "devil" and possible danger of fire. In order that the tape can be easily dropped to the bottom of the tube after the required depth

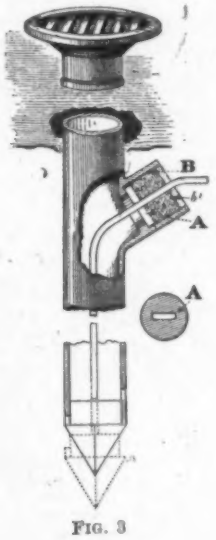


Fig. 3

for the earth has been reached, there is a free way through the socket. This space is afterwards closed by the loose washer A, fig. 3, which fits into the socket, and lead yarn is tamped round the conductor a skein at a time, until the whole mass is solid. To guard against corrosion where the tape enters the socket, a space is left, which is filled with insulating material; and, to obviate surface leakage when used for earthing at electric light and power stations, an outer casing is fitted, and also filled up with compound. Fig. 3 also illustrates a new form of tubular earth (patented) which does not require a watering pipe. A funnel-shaped cast-iron top, fitted with a removable strainer, is sunk level with the ground, and collects the rainwater. The lower tube is not perforated, but has a loose point, which engages by means of two lugs with the tube when this is being sunk, and is afterwards driven further into

the earth by means of a rod inserted into the tube so as to form a space (as shown by the dotted lines) into which the conductor is dropped and surrounded with carbon in the same manner as in fig. 1. The detachable point method is recommended for use in ordinary ground, and for depths not exceeding 10 to 12 ft. For hard ground, such as gravel, sand, or chalk, or with numerous stones, fig. 1, which has a hardened steel point, should be used.

The problem to be considered in protecting a building from lightning is, first, to provide many points; this is very often facilitated by the existing metal work of the roof, as these projections also take the upward discharge and lessen the violence of a flash; secondly, there should be as many earth connections as possible; with tubular earths, small tubes, two or more in parallel, are preferable to those of larger surface area.

It is thought that the new method of utilising lead yarn for the purpose of electrical connections would be found a quick substitute in emergency work for the usual clamp. The patentee would be pleased to give facilities to electricians who wish to experiment with the material.

LARGE BATTERIES FOR POWER PURPOSES.

By E. C. McKINNON, A.M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

The apparently large batteries of 20 years ago were small compared with some of those installed in recent years. Really large batteries are still uncommon in this country, but there are sufficient to enable one to study the design, management, working conditions, and results obtained, and to appreciate that batteries can be successfully designed and built for almost unlimited capacity.

Large batteries have been developed in this country mainly as a result of healthy competition between British battery companies. More progress would have been made but for many obstructing factors, such as: (*a*) Irreconcilable prejudice against batteries, (*b*) difficulty in providing the necessary capital, (*c*) attitude adopted by Government Departments, (*d*) reluctance to allocate adequate space to batteries, (*e*) inadequate training of engineers, (*f*) misconceptions about batteries, their functions, &c., (*g*) lack of technical supervision over battery operators, (*h*) indifferent working conditions, (*i*) want of appreciation of the possibilities obtainable with batteries, (*j*) absence of standards.

The absence of standards is a distinct deficiency, and the author advocates an investigation into the possibility of drawing up suitable standards for battery specifications, design, method of testing, and maintenance agreements.

The conditions under which the battery will be operated form a most important factor in the results obtained.

The aspect of the room is quite important, and powerful sun-rays striking direct on portions of the battery will cause irregular working.

Ventilation is certainly important, but it should be confined mainly to the removal of gases. Strong currents of air should be avoided. Wherever there is a need for forced ventilation it is preferable to draw out the air, as the incoming air can be readily cleansed and the exhaust can be passed through acid filters or separators.

There is such a wide range of opinion as to the design of battery-room floors that the author hesitates to advance any rigid recommendations in this respect.

It is difficult to make an acid-tight floor with tiles or bricks set in cement. Asphalt is an excellent acid-proof covering, but it is not suitable to bear heavy concentrated weights, especially in a warm room. The best floor which can be used is probably one of vitrified brick or tile laid on concrete, with the joints pointed with an acid-resisting, asphaltic, or bituminous compound. The compound should be of such a quality that it will not become brittle, but will remain plastic at all times. The tiles should be laid about ¼ in. apart, so as to provide proper space for pointing. In cases where the battery room is not directly on the ground the extra precaution should be taken of placing a layer of felt or paper treated with acid-resisting compound on the top of the concrete. Cement will not resist acid for long, but modern batteries do not weep acid to any appreciable extent, and a cement floor will be found thoroughly durable if periodically swilled down with water.

The slope of the floor is important, and the author advocates a gradual slope of 1 in. in 10 ft., from end to end of the room, or from each end to the centre, terminating in gutters, and no fall or slope across the room. Any supports below the lowest tier of insulators form part of the building, and not part of the battery. These supports of whatever description should terminate in a dead-level surface of uniform height. Wooden floor plates at right angles to the stillage have the advantage of distributing the weight, but are an obstruction when swilling down the battery room.

The construction of the walls is not of minor importance. Lime-washed walls are not very suitable, as the lime flakes off, and it has a neutralising effect on the acid in the cells. Mortar setting does not withstand the acid very well. A cement facing is good, especially if given a heavy coating of light-coloured paint. Vitrified bricks make a sound durable job, but better appearance is obtained from glazed bricks or tiles.

The type of ceiling or roof of a battery room is of importance. Whitewashed ceilings are even more objectionable than whitewashed walls; metal work, however high the roof and however carefully painted, deteriorates quickly. Ferro-concrete has the objectionable quality of "sweating." For appearance and durability a wooden ceiling painted or varnished has much in its favour.

A most unfortunate habit prevails of installing the battery and then setting to work to fit lamps, ventilating ducts, and supports for conductors, all of which could and should be done before the battery is assembled. If a battery is on an upper story it is better to be able to raise the goods through a hatchway in the floor. Overhead lifting tackle should therefore be provided, and in addition sufficient working space to land the goods and to carry out repairs should be allowed for in fixing the dimensions of the battery room. A sink should be fitted, and there should be a suitable water supply for cleaning out purposes. Facilities for replating and cleaning out a large battery should be considered when designing the room. Waste acid and sediment might be conducted outside the building to a convenient position for handling the acid and trapping the sediment, which has a value at least 25 per cent. that of the old battery plates per ton. Disposal of the waste acid is a problem which must be dealt with. The contention occasionally set forth that waste acid must be neutralised before passing to the drains is impracticable when dealing with large quantities. A complete water-supply system should be designed for the provision of distilled water, including the still, storage tanks, and the distribution pipes terminating in valves or taps. It is also useful to provide an effective acid pump with the necessary delivery pipes to obviate the haulage of carboys up to the battery room.

Good illumination in a battery room is required, but for inspection work a dark room with light concentrated on one cell at a time is found advantageous. Lamp fittings should be of porcelain, and should be assembled over the passages, and not directly over the rows of cells. Portable lamps are most serviceable if protected with wood or ebonite shields. The connections should be rubber covered, and wall plugs and sockets should be of porcelain.

Extremes of temperature do not occur in this country to an extent which renders it necessary to equip battery rooms with heating apparatus or cooling fans, but the effect of temperature on the capacity, efficiency, and life of a battery should not be overlooked. The objections to very high temperatures are mainly that any impurities in the battery are more active at high temperature, evaporation is excessive, the gas bubbles float in the air more readily, any acid spray dispersed concentrates more rapidly, and the strong acid attacks wood and metal work. The capacity of the battery is increased, consequently the plates can be overworked at the expense of their life. There is also a tendency for the woodwork to shrink at high temperatures. On the other hand, at low temperatures the capacity is temporarily lowered, the mean voltage on discharge is lower, and the main voltage on charge is higher. This results in a decreased efficiency. Further, if the pressure is lower on discharge, more current is required for the same number of watts. This increased current involves a discharge from the battery at a rate at which it yields a lower capacity, and to obtain even this capacity it may be necessary to run the battery down to a lower voltage.

The choice of material used as conductors may be left to the consideration of prevailing prices and local conditions. Bare copper rods for efficiency, appearance, and ease in assembling are readily first favourite with many. Bare aluminium is a strong competitor on the question of cost, but is less satisfactory in appearance and manipulation. Insulated cables are going out of use more and more wherever possible. Taped and braided cables are unsuitable. Lead-covered cables are cumbersome. India-rubber covered cables are quite satisfactory except as regards fire risks and their unwieldiness in heavy sections. If paint is employed to protect the copper or aluminium conductors in a battery room several coats should be applied, but owing to intermittent expansion and contraction there is always a tendency for the paint to crack, and concentrated acid—the residue of acid spray—will penetrate a hair's breadth crack and play havoc with the conductors. The most satisfactory form of protection is lead covering with the further protection of a coat of grease or paint, or, alternatively, a coating of vaseline on the bare copper or aluminium, occasionally wiped off and renewed.

Where possible the conductors may with advantage be supported by iron suspension rods and hangers, from which they may be insulated by split porcelain insulators designed for actually clamping the conductors in place. This is necessary because of the enormous forces which are exerted between parallel conductors carrying very heavy currents.

Large batteries usually require gangway platforms for purposes of insulation, or to bring the operator's head and shoulders above the level of the cells. An open lattice or rack pattern is satisfactory, but the author prefers a solid flooring laid on longitudinal joists, and for the purpose of cleaning the insulators and floor, the platforms should be made in closely-fitting removable sections.

Insulated earthenware pillars form an excellent alternative to wood stillage. Iron or steel girders and cast-iron standards have now rightly been abandoned as unsuitable for supporting a battery. Where wood stillage is employed it is advisable to split up the lengths into 18-ft. sections to improve insulation. It is also advisable to insert transverse gangways where the battery rooms are built very long. No rule can be laid down, but 40 ft. is found to be a convenient approximate maximum.

Although competition has led to some attempt at standardisation by battery makers, much remains to be done, and the desired object will never be achieved until the matter is taken up by representative bodies. Four main sections call for agreed-upon standards:—(*a*) Design of cells, (*b*) specifications, (*c*) tests, (*d*) maintenance agreements.

When dealing with design of cells, more especially those constituting large batteries for power purposes, the items may be divided into two categories, those open to standardsiation and the variables. The items to be standardised embody plates, electrolyte, separators, and containers.

It may be accepted that all large batteries will be assembled in lead-lined wood boxes. The thickness of lead lining need not be more than 3½ lb. per sq. ft. Provided that the battery is properly insulated, and that the negative plates are not allowed to come into contact with the lining, no depreciation through peroxidisation will occur. Similarly, if the lining is protected from any action by wood acids and is made of chemically pure sheet lead, no pitting will take place. Drainage between the lining and wood container is useful to carry away any condensation moisture, or to reveal a leaky lining quickly.

The relative height of the container to the height of the plates may easily be standardised; excessive freeboard above the plates would have serious drawbacks.

The depth of space below the plates should be deep enough to avoid frequent removal of the sediment, but not so deep that the acid in the electrolyte gradually settles down at the bottom of the cell. The space at the end of the plate section might quite definitely be standardised. Some space is desirable to keep the negative plates from the lead linings, and also to obtain the readings of the specific gravity of the electrolyte.

The actual shape of the plates is a matter which calls for too much difference of opinion to standardise, but the thickness of the plates can be agreed upon, and the minimum weight in pounds per ampere-hour capacity at a definite rating can be fixed in consultation with the battery makers. It might also be possible to agree upon a range of standard widths of plates in order to ensure a common pitch or distance between cell centres. The dimensions and shape of the supporting and current-carrying lugs might also be standardised, and thereby ensure that a replated battery will still present a sound engineering design irrespective of the make of plates. The distance between the plates determines the bulk of acid, the length of the cell, and the range in the specific gravity of the acid on discharge. If the thickness of the plates and the separators be standardised, then the battery user is able to requisition plates of any make for renewals. Having established a standard for the pitch of cells and width of plates, it is possible to standardise the dimensions of the channel bars and agree upon a fixed weight of these bars per unit length.

There is no reason why cell insulators should not be standardised, at least as to dimensions and design, assuming that British manufacture is stipulated. The number of manufacturers in this country is very limited, but it is worth noting that British-made green-glass insulators are in every way superior to foreign makes. The quality of the electrolyte is at present met by the expression "suitable for use in storage batteries." A specification might be drawn up by a Standards Committee bearing in mind that some of the Government departments have already put their house in order in this respect. Not only is the quality of the acid open to standardisation, but the normal working specific gravity of the acid in large stationary batteries can be fixed without any difficulty. The bulk of the acid for a given ampere-hour capacity at a definite rating is almost fixed by the above points, and may therefore be standardised.

It may be thought that so many items are open to standardisation that the variables are insignificant, and all batteries would consequently be alike. This is not the case, for there would always be master patents in the hands of one or other of the manufacturers, and workshop recipes, processes, dearly-bought experience, and reputation would all remain as jealously guarded as heretofore.

One of the most important improvements in modern storage battery practice is without doubt the practical adaptation of wood diaghragm separators. This involves the use of selected timber only, and an effective process to eliminate the wood acids and resin. Wood separators cannot be standardised in detail owing to the various patents covering their manufacture and treatment.

Construction of boxes or containers is a subject upon which opinion is divided. The present designs run on two well-established principles, namely:—Panel type, and solid wall type.

Cells constructed on either principle are giving satisfaction in service, but panel boxes appear peculiarly adapted for really large batteries. The combination of cheap timber and expensive paint will give better results than expensive timber and cheap paints. This question of a protective paint is of far greater importance than engineers appear to realise. The paint should be heavy bodied, acid-proof, and non-evaporative.

There are two distinct methods of building up the container linings—the mitred type, and the block bottom type, each of which has its advocates, but the question of cost is liable to be placed before that of efficiency. For very large cells the author advocates the mitred method in preference to the block bottom type, but not to such an extent as to recommend that it be standardised in specifications.

A table has been compiled from specifications issued during the past five years to show the wide variation in specified points, almost all of which might very well be standardised. There is some information to which everyone will agree; for instance, the number of cells for a given bus-bar voltage; the final voltage per cell at any given rate of discharge; the percentage capacity at various ratings, taking the five-hour rate as 100 per cent.; the ampere-hour efficiency of the battery; the watt-hour efficiency of the battery; the normal and maximum charging rates expressed as a percentage of the five-hour capacity; the maximum difference of potential attained by the battery on charge. Add to these the points open to standardisation in battery design and an equitable method of testing, and the battery specification emerges as a tangible technical proposal instead of a collection of irrelevant and inconsistent stipulations.

Should the author's proposals *re* standardisation be taken up and put into concrete form he advocates that the specification be revised at least every three years. This is important because advances in storage-battery design have not reached finality, and the makers now labour under the handicap of having to conform with specifications in several instances drawn up many years ago, and obviously out of date in important details.

The absence of official standard tests is felt acutely. Methods employed for testing the efficiency of a battery vary between exactly opposite extremes.

It is unnecessary to stipulate a standard method of testing for all batteries, but alternative methods might be standardised, and the particular one selected by the engineer should be specified. One satisfactory method of testing is to discharge the cells at a specified rate to a fixed final difference

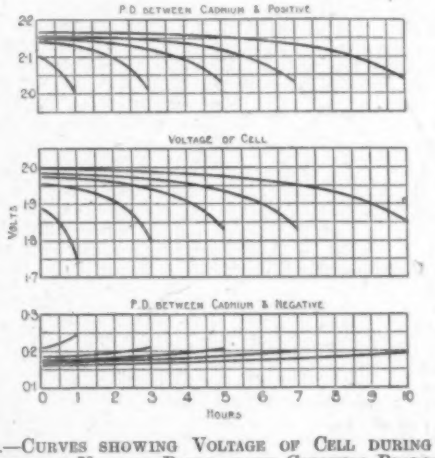


FIG. 1.—CURVES SHOWING VOLTAGE OF CELL DURING DISCHARGES AT VARIOUS RATES, WITH CADMIUM READINGS OF POSITIVE AND NEGATIVE ELEMENTS.

of potential, then to recharge the cells to an extent equal to 10 per cent. more than the number of ampere-hours discharged, and then to repeat the discharge. This will give the effective capacity and efficiency of the cells on the particular cycle, and will demonstrate the percentage margin of capacity possessed by the cells over their guaranteed output.

Another method is to discharge the battery at a specific rate of discharge to the guaranteed output, and if the voltage across the battery terminals does not fall below the prescribed limits this will prove that the battery has its guaranteed output. The battery should then be recharged, putting back 10 per cent. more ampere-hours than the guaranteed output, and the discharge should be repeated. The battery will have passed its test if on this second discharge the guaranteed output is again obtained without the voltage across the terminals of the battery falling below the prescribed limit.

The author favours this latter method for large batteries, because if the battery is to be maintained up to 100 per cent. of its guaranteed output, and this output is not to be exceeded at any time, the determination of the margin in capacity does not necessarily form part of the official test.

D

The diagnosis of a test is not generally appreciated. If a battery is low in capacity it is comparatively easy to locate the cause of the weakness. The hydrometer and cell-testing or switchboard voltmeter will indicate that weakness is present, but will throw no light on the actual cause. The metal cadmium affords a ready means of determining the relative condition of the positive and negative elements. Fig. 1 illustrates the method by which this diagnosis can be applied. The central diagram shows the curve of voltage of a cell during discharge at various rates. The upper diagram shows the curve of potential difference between the positive element and cadmium during discharge. The lower diagram represents similarly the potential difference between the negative element and cadmium. It may be noted that the voltage of the cell at any point represents the difference between the two values —potential difference between positive and cadmium and potential difference between negative and cadmium.

(*To be concluded.*)

Discussion in London.

Mr. C. H. Wordingham, President, said that with regard to standardisation there should be no difficulty in the matter with the Engineering Standards Committee. He agreed that battery tests required standardisation, but as to the design of cells he was not quite so sure. The Committee generally kept away from maintenance agreements, these being outside its scope, but the I.E.E. could form a committee to deal with this subject, and as to the question of paint, this could be referred to a panel of the Insulation Committee.

Capt. A. M. Taylor was particularly interested in the author's remarks relative to stand-by batteries. Opinions might be divided as to whether it would be better to have a battery which would give, say, 80,000 amperes for 10 minutes, or 25,000 amperes for one hour; but if one and the same battery would give *either*, then that was an asset of great value. It would be interesting to know what was the relative capital cost of such a cell, which he believed was made of thin plates, as compared with a cell intended for discharges up to three hours, or more, regularly. Did a battery really pay its way, not, of course, at the present price of lead, but at pre-war prices? It was essential that station engineers should agree as to the actual cost of the current put into the cells if put in at non-peak hours. Captain Taylor had maintained all along that this particular charging current only cost about 0.15d. per unit. If this were granted, and if he took the fixed charges—including up to the sub-station L.T. bus-bars—for one of the largest municipal generating stations* at £5 8s. per kw. of maximum demand per annum, and stand-by coal at 10s. per kw. of maximum demand, and pure running charge at 0.15d., then (*a*) With a load factor of 20 per cent. the cost of 1,752 units was at the rate of 0.959d. per unit; (*b*) with a load factor of 30 per cent. the cost of 2,660 units was at the rate of 0.684d. per unit, in each case with steam alone.

Considering the extra expense to the steam side of the station caused by the charging of the cells, neglecting the reduction in steam plant effected for a given maximum demand, 25 per cent. of the load curve area being put into the cells in the case of (*a*), and 33 per cent. in the case of (*b*), and 50 per cent. total loss, including boosters, being allowed in each case, they then got the following:—

(*a*) 20 per cent. load factor:—1,752 units at 0.759d. and 219 (waste) at 0.15d. = 0.98d. average per unit effective. Lost units represent only 1.6 per cent. of the total cost of the whole station.

(*b*) 30 per cent. load factor:—7,660 units at 0.684d. and 443 (waste) at 0.15d. = 0.707d. average per effective unit. Lost units represent only 3.64 per cent. of the total cost of the whole station.

The cost (including all charges of every sort) of the useful units actually obtained out of the cells (taking fixed charges for cells as in fig. 1)* delivered, as in the case of steam, at sub-station bus-bars where battery would be placed was:—

(*a*) 20 per cent. load factor:—1.2-hour rate, fixed charge £1 12s. per kw. per annum. 438 units at 0.88d. + 0.15d., and 219 (waste) at 0.15d. = 1.03d. Cost per effective unit = 1.105d. per unit, as against steam at 0.959d.

(*b*) 30 per cent. load factor:—2.43-hour rate, fixed charge £2 per kw. per annum. 886 units at 0.52d. + 0.15d., and 443 (waste) at 0.15d. = 0.92d. Cost of effective unit = 0.765d. per unit, as against steam at 0.684d.

The difference between the two costs would disappear if a rather smaller steam station were considered.

Mr. R. Crawford said he was glad to hear that tiles were going out of use as battery-room flooring; the acid was apt to get between and beneath the tiles, and the floor was thereby quickly ruined. Regarding fig. 3 in the paper, he said the weight of a battery should be taken up by the building itself, and not by the floor alone. In countries abroad the gravity of the acid was affected by heat much more than in this country, and this point should never be lost sight of by such users. Personally, he was biased in favour of booster regulation, and also he was in favour of the 10-minute rating. He thought the chief use batteries would be put to in the future was for stand-by purposes.

Mr. C. G. M. New agreed with the author's remarks as to battery standardisation, and he thought battery makers would also welcome the idea. Government specifications were impossible, and there had been difficulties in connection with the tests imposed by the Post Office. Station engineers and staffs too often looked upon the maintenance agreement as relieving them of all responsibility, so that it did not matter what became of the battery, or how it was handled. A point that was important, and should never be forgotten, was that the life of a battery was measured, not by time, but by the number of discharges it was subjected to.

Mr. Ll. B. Atkinson said he had occasion recently to build a floor which would have to withstand very similar conditions to a battery-room floor, and he had found the best material for use in making such floors was Staffordshire blue brick, which was quite acid-proof. Asphalt was a combination of natural bitumen and limey substances, and was not suitable for use in making battery-room floors. On making inquiries he had found a gas company who were prepared to supply a gas-tar pitch for use in place of ordinary asphalt which was perfectly acid-proof. This gas-tar pitch, together with Staffordshire blue brick, made the most suitable flooring, he thought.

Mr. R. Rankin said an adequate water supply was essential to every large battery; too often one found dirty water being used, with consequent damage to the battery. Provision for getting rid of the waste acid was most essential. The efficiency of a battery was greatly affected by the auxiliary plant used in connection with it, and the latter should, therefore, always be kept in good working order. There was a question as to which type of cell was preferable—the deep or shallow cell. In a deep cell the acid was not uniform, it became much stronger at the bottom. The evaporation was practically the same in both types of cell, but in the case of the shallow cell the level of the acid remained much more uniform.

Mr. E. T. Williams said the paper was a very valuable one, and the greatest difficulty which had to be overcome was the "irreconcilable prejudice against batteries" which the author had mentioned. More attention should be given to the maintenance and repair of batteries. It should be remembered that "a stitch in time saves nine," and users of batteries were too often apt to let things slide until it was too late to make proper repairs. Batteries were very often most unsuitably housed, and another common fault was that in many cases the battery was designed without due consideration of the future expansion of the supply, and in consequence, after a short time, the battery had to be overworked. It was most important that a battery should be properly used, and details must never be neglected. He understood that quite recently a satisfactory acid-proof cement had been made. Touching standardisation, he said this was very important, and most desirable. It should be noted that in batteries destined for the Tropics more allowance must be made for expansion; plates were frequently buckled through not having sufficient room to expand. He thought that the future use of batteries would be mainly in the nature of a stand-by, or to meet short, heavy peaks. He had recently had to consider the supply of three towns, and after going into the various methods available he had been struck by the many points in favour of a battery in each town, all supplied from one central station. He thought the question of installing batteries on consumers' premises should be gone into more fully, because they could in this way increase the load factor, and enable lower charges to be made.

Mr. E. C. McKinnon, in reply, said that nearly all specifications to-day were quite useless, because in many cases very old ones were used over again with simply a few figures altered to meet present conditions. It was not now usual to cover paint with varnish; when paint was used it must be good, and a thick coating should be put on. He thought that in this country we were following five years behind the U.S.A. in central-station practice. It was thought quite ample in the U.S.A. if the battery was capable of taking up the load for 10 minutes. Here, in this country, only a very mild protest was raised when the supply happened to fail; it was very different in the U.S.A. It was very difficult to say whether booster regulation was better than other systems, and as to capital cost of a stand-by battery, it could not be given owing to present prevailing conditions. In an up-to-date battery room the floors were by no means wet, in fact they were often dusty, and both cement and tile floors were quite satisfactory provided the latter were properly jointed. Bare aluminium conductors deteriorated very quickly, and welded joints were not easy to make. Bolted joints were simpler, but copper conductors were easier to handle and work in every way. With regard to wood separators, an old battery could be improved 25 per cent. by their use. There was no difficulty in disposing of waste acid, as there was always a ready sale for it. The battery tests in use to-day were most crude; if the number of discharges of a battery was taken as its life the agreement would run out in about three years, and the human element must not be forgotten when a maintenance agreement was being drawn up.

Discussion at Birmingham.

Mr. E. C. McKinnon's paper on large batteries for power purposes was read and discussed before the Birmingham Local Section of the Institution of Electrical Engineers on April 17th.

*See table in the *Electrician*, December 4th, 1907.

Mr. G. Rogers said the paper would prove a useful guide to engineers who had to consider the question of installing batteries for power purposes. The author was rather severe upon the engineers who had been responsible for the drafting of battery specifications, but it must be remembered that the educational facilities for large battery work had been non-existent. With regard to the author's remarks upon the obstructing factors which had caused delay in the progress of battery installations, he would like to draw attention to another factor, the failure of battery makers to meet their responsibilities under maintenance contracts. Battery makers neglected to watch the daily records, and delay ensued in carrying out the necessary repairs. The terms of the maintenance contracts, and the representations of the manufacturers to their customers as to the treatment of their battery plant had largely been responsible for the idea that batteries had to be treated as invalids. The maintenance department should be in constant touch with all records, and be regular in the periodical inspections; the instructions for the working of the battery should also be stated as simply as possible. It was very interesting to note than an English engineering firm was now prepared to turn out large switches for use with regulating cells. From the diagram these switches bear a great resemblance to the switches supplied by Siemens, of Berlin. One feature, lacking in the Siemens switch, was very important, viz., the switch was capable of being operated and cells cut in when the load was considerably more than the full rated load of the switch. He was inclined to think that in this country the developments of electrical supply were likely to cause a decreasing demand for batteries. It would seem that the distribution of power for lighting and power purposes in the future would largely be by means of three-phase, four-wire networks. It must be remembered that cheapness of supply would be the dominating factor in this development, and reliability and continuity of service would have to be provided by means of duplicate supply. The losses incurred in the use of converting plant and battery auxiliaries would therefore be avoided. Even the country-house battery plant was likely to be superseded sooner or later by the transformer. There was, however, likely to be a demand for buffer batteries for use with traction systems if direct current was eventually adopted for the electrification of railway systems.

Mr. F. Forrest said large batteries, whether for stand-by purposes of for more general use, were likely to be installed in stations situated in crowded areas. Owing to the great volume of acid-laden air which would be discharged from battery rooms containing large batteries, it was necessary to prevent this being a nuisance to surrounding property owners. "Acid neutralisers" had been in use for years in the U.S.A., but very few had been installed in this country. Two were erected in one of the sub-stations in Birmingham, and had proved very satisfactory, these having been built to designs of the chief engineer of the New York Edison Co. An efficient distiller should form part of every large battery equipment. A very satisfactory arrangement was to keep the distiller working constantly, and to store the distilled water in wood lead-lined tanks mounted some distance above the top of the cells, so that the water could be drawn off by gravity. Before any of the distilled water was used, samples of it should be drawn off and tested, either with the Dionic water-tester or by the nitrate of silver test. A portable milking booster was also a necessary accessory, and a very good form to adopt was one which combined on a single carriage the small motor generator, together with all necessary switchgear and instruments. A number of concentric plugs should be arranged round the battery room so that the polarity could not be altered, and as far as possible the machine should be rendered fool-proof. The whole equipment should be mounted on rubber-tired wheels, and arranged to turn into any of the gangways with ease. The watt-hour efficiency of a battery was so difficult to accurately determine that he suggested it should be no longer included in battery specifications. Ampere-hour efficiency was really all that one wanted to know, and that should be the standard upon which to frame guarantees. To obtain the watt-hour efficiency it was necessary to re-charge a battery to exactly the same condition in which it was before the discharge test commenced, and it was almost an impossibility for even an expert to state when a battery was in precisely the same condition, both as regards its voltage and specific gravity. A short period of under-charging would improve the apparent efficiency and upset the accuracy of the test. The usual type of hydrometer in use was a rather unsatisfactory means for testing the condition of large batteries, and he asked the author whether he was acquainted with any other form of hydrometer having a larger and better defined scale than the small things one was compelled to use at present. Working to specific gravity alone was one of the most satisfactory ways of operating a battery, and it was, therefore, very essential that the hydrometers used should be of the best possible type. With regard to the control of large batteries, there were in use in Birmingham a number of regulating cells generally of the type illustrated in the paper, but, unfortunately, these were obtained from abroad. Each half battery in connection with a three-wire system was controlled by one of these switches, which was connected between the neutral point and the battery, so that there was a minimum voltage to earth on the switch. This was a very important point to watch in connection with either boosters or cell-regulating switches. The working results with large and small batteries had demonstrated that the trouble experienced was inversely proportionaly to the size, and those people who had connected solidly to their bus-bars a large battery appreciated its value, especially in times of emergency.

REPORT OF THE BALFOUR COMMITTEE ON POST-WAR TRADE POLICY.

The Committee on Commercial and Industrial Policy After the War, which has been presided over by Lord Balfour of Burleigh, was appointed in July, 1916. Its reports—four in number—have just been issued by the Ministry of Reconstruction. Three interim reports deal in detail with certain branches of the problem, and a final report embodies briefly the conclusions of these three and adds final conclusions.

In regard to the position of British trade and industry at the outbreak of war, the Committee find that the older industries, with one important exception, showed at that time great vitality and power of expansion. This exception was the iron and steel industry. In this manufacture, and also in the newer branches of industry (chemicals, metals, electrical appliances, &c.) Great Britain's position was not nearly so good. In the general world expansion of these manufactures Great Britain had taken a very limited share. In numerous branches of trade, outside the great staple trades, foreign competition had become increasingly acute, and foreign manufactures had secured a strong, or even predominant, position; several branches of production, of greatest importance as bases for British manufactures, had come to be entirely or largely under German control.

Great progress towards remedying this condition of things has been made during the war, and the Committee think that the experience gained should be a most valuable asset; but they emphasise the importance of every effort on the part of employers and employed to attain the largest possible volume of production in order to secure the speedy recovery of our industrial and financial position.

They recommend that the present prohibition of the importation of goods of enemy origin should be continued, subject to licence in exceptional cases, for a period of at least 12 months after peace, and for such further period as may seem expedient; also that the British Empire and the Allies should adopt a policy of joint control of the export of certain important materials which will be required for the restoration of their industries. As part of these arrangements the Committee recommend the Government to consider the establishment of a joint organisation for dealing with Allied orders for reconstruction purposes. It will be necessary, they consider, to continue for some period after the war some part of the control of home and foreign trade imposed during the war in order to secure adequate supplies of foodstuffs and raw materials, and their fair distribution. But such restrictive measures should be kept within the narrowest possible limits, and, wherever practicable, the trades and industries themselves should be entrusted with this control, under Government authority. State restrictions on industry should be removed as soon as possible after peace.

As to the supply of raw materials, the Committee consider that any attempt to make the Empire self-supporting would be neither practicable nor economically sound. They favour a "selective policy" which shall have regard to the relative importance of each commodity, whether industrial or military, the sources of supply, and the likelihood of their disturbance in case of war. This method would yield more rapid progress, they consider, than the proposal made by the Dominions Royal Commission to establish a single Development Board. Special inquiries should be instituted, they consider, on the lines of the Committee now investigating supplies of cotton within the Empire, to deal with each commodity that may be selected for treatment on the principles suggested, the general aim being to assure that the Empire in an emergency should be independent, for its supply of any essential commodity, of any single foreign country or possible combination of countries.

The subject of essential industries is dealt with in considerable detail in one of the four reports, which shows how certain of the largest British industries had come to be dependent upon enemy sources for relatively small, but essential, commodities. The Committee recommend as a national safeguard against any recurrence of this condition that a Special Industries Board should be established, having the duty of watching the course and trend of industrial development, and of framing from time to time detailed schemes for the promotion and assistance of industries concerned with the production of these essential commodities.

With regard to the position of aliens, the Committee, while thinking that in the main it would not be desirable to impose restrictions on the participation of aliens generally in commercial and industrial occupations, recommend the reservation of certain occupations, such as pilot and patent agent, to British subjects. They suggest also the licensing of foreign commercial travellers; the registration of all titles to property, with a declaration as to the nationality of the owner or transferee; powers for the Board of Trade to inves-

tigate the ownership and control of any particular company; licences for foreign banks and insurance companies, and, in the case of the latter, the lodging of a money deposit; stringent police regulations for a period after the war concerning subjects of present enemy countries. It would be impracticable, the Committee think, and inexpedient to impose any restrictions as to the use of London credit or insurance facilities. [We referred to the Committee's conclusions regarding trade organisation last week, p. 387.]

On the subject of financial facilities for industry the Committee are not able to recommend the scheme for the establishment of an Imperial Bank of Industry. The financial needs of British industry, they consider, are likely to receive better examination, and to be met in a more effectual manner, under private banking enterprise than under a State-controlled institution. As a general rule, they think it undesirable that the State should attempt to provide capital for industrial purposes. The Committee also recommend investigation as regards taxation (especially in connection with the income-tax allowances for depreciation of industrial plant), currency, and for the maintenance of foreign exchanges, such as is now being carried out by Committees of the Ministry of Reconstruction and H.M. Treasury. The remedy for shortage of capital after the war, however, must be sought mainly, the Committee consider, in the increase of production and saving. Appreciable aids to these ends can be found in the avoidance of unnecessary expenditure by the State, and in the extension of the taxation of luxuries.

The Committee make recommendations as to fiscal policy in the light of war experience. First, they lay down various propositions as the bases of future economic policy. Among them are:—

1. Government action to promote and safeguard "pivotal" industries (industries on which depend other and larger branches of important national production).
2. Government assistance to industries which are important for maintaining the Kingdom's industrial position, but which are unable to develop themselves by reason of undue foreign competition or other causes.
3. Efforts to meet the declared wishes of the Dominions and Colonies and India for the development of their economical relations with the United Kingdom.
4. Efforts to develop trade with our Allies.
5. Subject to agreement with our Allies, the refusal for a time, at least, of trading facilities to present enemy countries on the same unrestricted terms as before the war, or on terms equal to those accorded to Allies or neutrals.

A majority of the Committee do not think it expedient to establish a comprehensive tariff scheme covering the whole range of imports into the United Kingdom, and they advance the following reasons for their opinion:—

1. A claim for protection cannot be regarded as valid unless the industry which makes it can show that, in spite of the adoption of the most efficient technical methods and business organisation, it cannot maintain itself against foreign competition, and that by such competition, it is hindered from adopting these methods.
2. There are large branches of production (as in the cotton trade) in which there is no demand for any measure of protection.
3. Any State action towards the indiscriminate maintenance of industries which do not contribute appreciably, or at all, towards the national wealth would be economically unsound.
4. Any State action likely to raise prices, even temporarily, for commodities of national importance should be confined to the closest possible limits.
5. It is of paramount importance that our export trade should not be hampered by any policy which might unduly increase the cost of production in this country, as compared with the cost in other countries; and a more limited tariff could be used equally well, though not so extensively, for granting Imperial preference, and for the purpose of negotiation with foreign countries.

The Committee, after examination of the main considerations involved, come to the following conclusions:—

1. Producers in this country are entitled to protection against "dumping" and the introduction of "sweated" goods, and Government action on the lines adopted by Canada is recommended.
2. "Pivotal" or "key" industries should be maintained at all hazards and at any expense.
3. In other industries protection, by means of Customs duties, or Government help in other forms, should be provided only for reasons of national safety, or on the general ground that no industry of real importance to our economic strength and well-being should be allowed to be weakened by foreign competition, or brought to any extent under alien control.
4. Preferential treatment should be accorded to the Oversea Dominions and Possessions in any Customs duties now or hereafter to be imposed in the United Kingdom, and consideration should be given to other forms of Imperial preference.
5. The present opportunity should be taken to promote our trade with our Allies, and consideration should be given to the possibility of using for purposes of negotiation with them and with present neutrals any duties which may be imposed in accordance with the foregoing principles.

The Committee add that, in view of the danger that the admission of the principle of protection, even to a limited extent, may give rise to a widespread demand for similar assistance for other industries, and consequently to an amount of political pressure which may be difficult to resist, they recommend the establishment of a strong and competent board, with an independent status, to examine all applications for State assistance, to advise the Government upon them, and, where a case is made out, to frame proposals as to the nature and extent of the assistance to be given. Before recommending tariff protection this board should consider forms of State assistance other than, or concurrent with, protective duties. It should have constantly in mind the safeguarding of the interests of consumers and of labour.

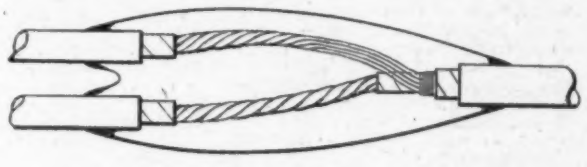
The report comprises chapters on the metric system and decimal coinage, neither of which the Committee felt able to recommend for adoption in this country.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Joints on Triple-Concentric to Three-Core Lead-Covered Cables.

I have read Mr. Wardle's article in the ELECTRICAL REVIEW, and may state that I have made joints on the same principle, but without fittings, on the triple-concentric cable. I used to put a tinned copper binder, 1½ in. long, on the concentric, intermediate and outer, lay the wires together, making a core, and then telescope on to three-core cable, sweating all solid from the tinned copper binders to the telescopic joint. The different engineers I



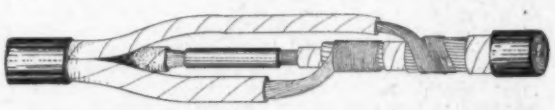
have worked under have found, by telescoping the joints, that a smaller lead sleeve can be used than with fittings. I enclose a rough sketch, showing how I have, also, in several instances, jointed two single lead-covered cables to a concentric cable, making the lead sleeve into a trousers joint. I have been a cable jointer for 24 years, and a foreman plumber jointer for the last 15, so write from experience.

P. H. Williams.

Charlton, S.E., *April 27th*, 1918.

Referring to the article by Mr. P. Wardle in this week's issue the enclosed sketch shows a method which has been adopted in this district, whenever necessary, for the past 14 years. The positive or centre core of the triple-concentric cable is either telescoped or jointed with a metal sleeve to one core (clover leaf) of the three-core cable.

The negative and mid-wire cores are stripped back about 2 in., with 1 in. of insulation between each, the copper slightly raised, and a piece of tinned copper strip put underneath with mica between this and the paper insulation. The wires forming the cores of the three-core cable are then spread out and laid round



the concentric cores and bound down with binding wire, the whole joint then being sweated solid in the same way as if it were a concentric to concentric joint. Each core and joint is insulated with tapes boiled in resin oil.

A ·2 ·1 ·2 triple concentric to ·2 ·1 ·2 three-core joint of this character can easily be got into a 3¼-in. lead sleeve, and a ·3 ·15 ·3 three-core to ·6 ·3 ·6 triple-concentric joint has been got into a 4-in. sleeve.

Several of these joints have been in use for years, and we have never had the slightest trouble with them.

F. D. Balshaw,
Willesden Electricity Department.

Kilburn, N.W. 6.

Coil v. Magneto.

With reference to the letters on the above by Mr. E. G. Ford and "Unsettled" in the "Correspondence" columns of your March 22nd and April 5th issues, many points of interest to readers are raised, and as I have devoted considerable attention to car lighting, starting, and ignition by electrical means for some years, I will endeavour to make a few observations and suggestions as the result of experiment and experience.

Dealing with Mr. Ford's query as to a good coil system being superior to magneto, there is so much in this connection that is still debatable that I prefer to assume this to be still an open question.

To begin with, what is a good coil system? There is the "auto-sparker" single-wound coil used in conjunction with a small D.C. generator, the double-wound (primary and secondary) coils with and without tremblers, operated either by dry cells, accumulator, D.C. dynamo, or, in the case of the Ford car, by an alternating-current generator, and many other systems. All have their virtues and their vices, and whilst some years ago British manufacturers were casting about for some finality and standardisation in car-coil ignition systems, the Bosch Co. fairly captured the field by their energetic and systematic production of really high-class magnetos.

I think the present position could be summed up by saying that the magneto holds the field, owing as much to energetic manufacture and "fashion" as to its reliability as compared with a developed coil system such as is seen on the Ford car. The success of the latter seems to have proved an incentive for reversion to coil ignition in America, as mentioned in the Electrical Review a little time back.

One of the most distressing troubles met with in connection with coil ignition systems has been due to the platinum points in the trembler. Attempts to eliminate the trembler wholly or partially, relying upon the single spark produced by the sudden "break" of the contact device attached to the engine timing gear for ignition, have now been practically discarded owing to the single chance of the single spark to do its work of producing proper ignition at all times without "missing." It is true that the magneto gives practically a single spark for each "firing," but unlike the spark from a coil (without trembler) its spark is not momentary, but, to a certain extent, "sustained." I think it is, therefore, manifest that, owing to the nature of the discharge from a coil, the trembler device must be considered an essential to faithful operation.

Having got thus far, let us examine the causes of platinum contact troubles. In the early coils these were due to (1) bad design of coil windings and dimensions relative to the operating current; (2) area of contacts much too small for long "life" before requiring adjustment or renewal; (3) the exclusive use of continuous current for operating the coils. The latter statement may cause surprise in some directions, but I find that alternating current to operate trembler coils does not burn up the platinums anything like so soon as current (continuous) from a dynamo or battery. I will not explain here why this is so; I simply give it as a fact of experience. The first two drawbacks have now been overcome by proper design and good robust platinum contacts. Number three seems to be minimised in its effects by the alternating-current system, for which the Ford car can claim to have given us an improvement; but, in spite of the advantage of alternating current, I have obtained very satisfactory results with battery operation—enough, in fact, to justify the assertion that the coil can quite hold its own with the magneto. If "Unsettled" knows of a really good contact breaker, apart from the ordinary design, or modifications well made, I suggest that the world would welcome it, so please tell us more about it, as the times are too momentous for anyone of inventive genius to hide his light under a bushel.

There is just one other point which I will briefly refer to, and that is that the magneto has gained a lot of its popularity owing to the respect with which it has been treated by the average run of motor mechanics. If a magneto has got "out of sorts" it has generally been returned to its maker, whereas coil systems have been "tinkered to death" by a host of "motor traders," whose only reputation for ability or claim for competence seems to be to belong to one of the "Motor Trade Protection Associations" formed for that purpose.

It is a fact, I believe, that these Associations have the temerity and audacity to protect their members to the point of excluding qualified electrical men from doing electrical car work, by forbidding their members (manufacturing) to supply electrical firms at trade terms. The result of this organised prejudice has been to hinder progress, but, mark this—only for a time.

When this ghastly war is over, Electrical "Protective" Associations will see to it that the present motor industry "poachers" are cleared out, and that "coil or magneto," or any other useful electrical device, will have fair play in cars or anything else, and not be at the mercy of the ignorant or the whimsical.

J. R. Parkington.

Newcastle Emlyn, S. Wales,
April 29th, 1918.

The Electrical Power Engineers' Association and the Association of British Electrical Engineers.

"Doubtful," in his letter published in your issue of April 26th, puts his finger on one of the weak points of the proposed Association of British Electrical Engineers. Independently of the Whitley Reports, the legal position is this: That a body of this kind must either be incorporated, or registered as a Trade Union. (The possibility of operation under a Royal Charter cannot profitably be considered at present.) If the Association be incorporated it is at once debarred from obtaining any financial benefits for its members; consequently its principal object, the increase of insufficient salaries, becomes impossible of attainment. If it were neither incorporated nor registered as a Trade Union it would have no legal status, and in the event of any drastic action being forced upon it—not by any means an impossibility—its members would presumably become liable to a prosecution for conspiracy. The high and mighty "in no sense a Trade Union" thus reveals itself under analysis as a very futile piece of snobbishness.

This matter was several months ago very carefully gone into by the Electrical Power Engineers' Association, and, legal advice having been taken, this body had the good sense to see that registration as a Trade Union was the only sensible course to adopt at present, and by this policy it not only becomes a legal entity, but is also entitled to look after the financial interests of its members, to enter into negotiations as an organised body, to representation on Industrial Councils, and to all other privileges which Trade Unions enjoy. At the same time, mere Trade Unionism by no means contents it; its ambition is to become a professional association of engineers, membership of which should be a hall-mark of electrical engineering ability.

Although the E.P.E.A. has only been in existence a few months, it already numbers over a thousand members, who are drawn from all grades, from chief engineers and chief assistants downwards. It is obvious, therefore, that no considerations of "dignity" ought to prevent any qualified electricity supply engineer from doing his plain duty to himself and his fellow engineers by joining the Association, which is already a living force. To sit on the fence or to support any other body setting up to be a protective organisation is to weaken our forces and to waste our opportunities. The only doubt on this matter which ought to exist in anyone's mind is whether his qualifications are sufficiently high to entitle him to membership.

E. B. Pausey.

Bury, Lancs., *April 29th*, 1918.

With reference to the letter from "Doubtful" in your last issue, it may be interesting to know that the Electrical Power Engineers' Association has on many occasions of late been occupied in discussing the advisability or otherwise of Trade Union registration or incorporation.

We have in our ranks some who still blush at the thought of their membership of an Association with such registration as projects before their delicate imaginations a film in which "grousing," slackers and agitated tub-thumpers appear in scenes of "ca' canny" and down tools.

To correct their focus and disprove these erroneous notions, our president has arranged to read a paper on "Registered or Incorporated Societies," at a meeting to be held at an early date. We have made strenuous efforts to do the right thing in the interests of our members, and after careful consideration of all points of view, of Government action, of Whitley Reports, and having obtained the best legal advice, we decided on registration.

Our membership now comprises over 1,000 engineers, representative of all branches of the electrical industry throughout the country, many of whom are already members of the Institution of Electrical Engineers. Naturally, we would have esteemed it an honour had we the blessing of the premier Association, but always there has been this obstacle of the fixed idea, the illogical antipathy to Trade Unionism and its reputation aggressive. Curious that this should rest even on the E.P.E.A., whose loyalty has been tested and not found wanting, and whose mild activities would compare not unfavourably with those of any society of curates.

We have high ideals and bright hopes for the future of our "Trade Union," and are determined that we will bring no discredit on our profession.

We trust that, by our conduct of affairs we may show the reactance utility of our Association to the whole industry, and that we may yet command the approval and respect of the I.E.E.

George C. Law.

London, S.W., *April 30th*, 1918.

[The point raised by "Doubtful" certainly appears to be of the first importance. We see no good reason why the B.E.E. should not register as a Trade Union; no discredit attaches to Trade Unionism in the abstract—it is only the *abuse* of the principles of Trade Unionism that has brought it into bad odour. The Whitley Report advocates the development of those principles and their extension to employers also.—Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Lauraine High-Tension Magneto.

A new high-tension magneto, known as the Lauraine, has recently been put on the market by the Menominee Electric Products, Inc., of New York. The machine, which is of conventional design, is made in all standard sizes for motor vehicle, marine and tractor work, and is entirely waterproof; in addition, a special aircraft model is being manufactured, in which, by the use of aluminium and other light material, a saving in weight of about 4 lb. has been effected.

From the accompanying sectional view, p. 418, most of the important constructional details may be seen. The armature is of the Siemens shuttle type, and carries both the primary and secondary windings. One end of the primary winding is earthed on the armature core, while the other end is carried out to the contact breaker on the end of the armature shaft. The contact-breaker arm is built up of cross-sectional fibre working on a pin which is integral with the main contact-breaker block, thus preventing undue compression and expansion due to moisture or high temperature. The contact-breaker cam is cut from steel tubing, shaped, hardened, and ground

to size, and it is claimed that, as a result of this construction, absolute synchronism is assured.

The high-tension current is collected from the armature through a collecting ring and brush at the driving end. The usual safety spark gap is provided, and the distributor gear is adjustable for wear. The waterproofing cover is inside the horse-shoe magnets; hence the magnets and also the end plate can be removed without

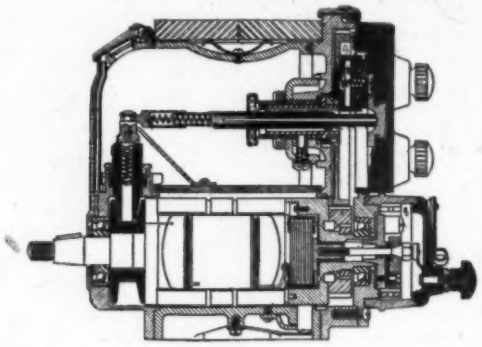


Fig. 1.—Section of Lauraine H.T. Magneto.

disturbing the waterproofing, and the latter can also be easily removed, should it be desired. All castings, bases, and end plates of the machine are of bronze, while the armature is supported on annular ball bearings, and the distributor on a plain bearing of liberal size provided with wick oiling.

Electric Army Kitchen for Field-Service Use.

One of the developments made in the utilisation of electricity for war purposes is a portable electric army kitchen designed to meet the requirements of Red Cross and army field service. The kitchen heat is obtained by the combined use of an electric

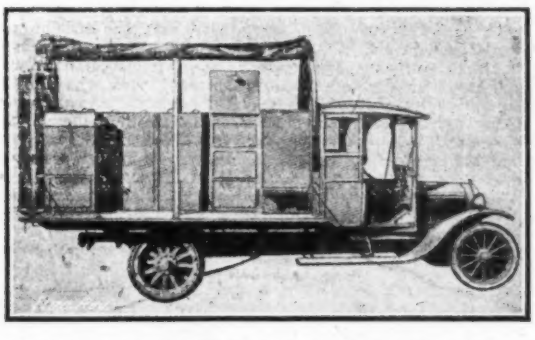


Fig. 2.—Portable Electric Kitchen for Army Use.

generator driven by the automobile motor and the heat from the exhaust of the motor, which amplifies the heat obtained through the use of electricity.

The portable army kitchen is equipped with two 30-gallon fireless cookers, with a 26-hour cooking head efficiency: a 30-gallon coffee urn, a 30-gallon vegetable and soup urn, baking and warming ovens, and two large hot-water sterilising tanks, which are designed to sterilise 120 gallons of water in two hours. The generator develops a current which is said to throw a searchlight ray for 3 miles, and will carry a load of 600 110-volt lamps.

Because of the tie-up of the generator with the automobile motor, this kitchen can be operated either while travelling or while at rest.—*Electrical World.*

LEGAL.

Wireless Spark-Gap for Curing Shell Shock.

In the Patents Court, on Thursday, last week, Mr. E. E. Greville, of 167, Gray's Inn Road, London, maker of electromedical instruments, applied for licence to use a German patent—6,424 of 1909—for a wireless spark-gap, in the manufacture of an apparatus for curing shell shock. The application was heard by the Comptroller-General of Patents, Mr. Temple Franks, and Sir Cornelius Dalton.

Mr. H. A. Gill, patent agent, of 55, Chancery Lane, London, represented Messrs. W. P. Thompson & Co., of Liverpool, communicatees of the Gesellschaft für Drahtlose Telegraphie m.b.H., of Berlin, and explained that the main feature of the invention was a spark-gap having the electrodes placed very close together, and the surfaces of high thermal conductivity. The claim was "for an apparatus for producing but slightly damped electrical oscillations by the shock excitation method, and employing a very short spark-gap having parallel electrodes, in which these electrodes are made of a material which conducts heat as well as, or better than, gold." The feature was the use of such a spark-gap, preferably in annular form—in the constructional forms it was essential that all sharp edges should be avoided; there was a central gap, and the edges were enclosed by a ring of mica, or something of that sort. The patentee, to secure his high conductivity, went on to make up his plates in sets or series, with a series of water-cooling chambers between the spark-gaps. They were connected by cooling ribs with the electrodes. By the cooling means and several spark-gaps the patentee got longer range in wireless telegraphy. A simple spark-gap soon reached its limit. The energy converted into oscillations was increased beyond that limit by a plurality of spark-gaps.

Mr. Greville explained that the apparatus could be used for the high-frequency treatment of shell shock and nervous cases.

The Comptroller: Has this patent been used before for electropathic treatment?

Mr. Greville replied that, so far as he knew, the invention had never been so applied. He perceived its uses, however, in this field, and he proposed both to make and to sell machines working upon this principle. He would supply spark gaps as separate units for incorporation in existing machines, always to be used for medical purposes.

Mr. Gill said that the whole purpose of the apparatus was to get a longer range in wireless signalling. He was satisfied that the invention never contemplated such a use as that to which Mr. Greville proposed to put it.

Answering the Comptroller, Mr. Greville said certain modifications would be required when the spark gap was fitted to existing machines. He thought the price would be about £3, and he was ready to pay a royalty of 5 per cent.

Mr. Gill remarked that there were three previous patents which were germane to the present invention, but he did not think that any of them would affect the applicant's use. All seemed to be directed to wireless telegraphy. They were in the names of well-known wireless men—17,349 of 1908, in the name of Lepel; 4,809 of 1907, in the name of Poulsen; and 3,783 of 1907, in the name of Dr. Max Levy.

An engineer who was in Court watching the proceedings, interposed to say he understood that Mr. Greville was not applying for an exclusive licence, and that other people would be at liberty to apply.

The Comptroller replied that that was so. It was not the custom of the Court to grant exclusive licences. The whole theory of its work was that it was solely for the public benefit that these licences were granted. There was no other point of view. The Comptroller, in intimating the decision of the Court, said that Mr. Greville had satisfied the Court that there was good reason for supposing this invention might be of use in his profession. The Court saw no reason why the licence should not be granted, and Mr. Greville would accordingly be notified at an early date as to the issue of his licence.

White and Others v. The Mayor and Corporation of Dover.

Mr. Justice Bray and a special jury, on April 23rd, concluded, in the King's Bench Division, the hearing of an action in which damages were claimed by Mr. Albert White, the lessee of two houses in Folkestone Street, Dover, and Messrs. C. Ward and A. R. Adams, the freeholders, against the Mayor and Corporation of Dover, the electric lighting authority of the town, alleged to have been occasioned by the negligence of their workmen in laying an electric cable into one of the houses. The defendants admitted having laid the supply into the house in accordance with the plaintiffs' request, but denied that there had been any negligence in carrying out the work. They said that the only interference with the brickwork, which was very old, had been the removal of a single brick, which had been pushed out by a man's hand to allow the pipe carrying the electric wires to pass through from the roadway into the house. The hole thus made, it was said, was cemented up and made good directly the work was finished.

The case for the plaintiffs was that Mr. White, whose lease would expire in 1920, let one of the houses to a boot repairer, and that tenant at the end of 1916, being desirous of using electric current for the purposes of his business, for lighting, and driving a boot-repairing machine, applied to the Corporation to lay wires into his premises. They, as owners of the electricity supply of the town, accordingly undertook the work, and sent men to carry it out. They laid the cable in the ordinary way, but plaintiffs alleged that the work was done negligently, and that the brickwork of the foundation had been so disturbed as to cause a subsequent subsidence and a bulging of the walls.

Mr. Enoch Clarke, the tenant, said that when the cable was put in he heard the workmen using force upon the brickwork, through which they appeared to be driving a heading into the shop, and early in 1917 he found that the windows had begun to bulge both inwards and outwards. When he complained to the Corporation, they sent a man to put in cement or concrete.

Mr. Joseph Jennings, an architect of Canterbury, stated that upon examination of the premises he found that the brickwork had been disturbed, and that was the cause of the trouble. In his opinion, if proper care had been taken in putting in the cable the trouble would not have arisen. He estimated the cost of putting the matter right at about £100.

Mr. Barrington Ward (for the defence) asked the witness whether he had seen the premises since "the little encounter with the Germans," and witness replied that he had not, as it was not easy to get to Dover now.

Mr. White (plaintiff) recalled, said they were now repairing the shop front, which had been damaged by air raids, but they were not touching the "storey part," where the damage complained of had occurred.

For the defence, Francis Thos. Ashfield, a ganger on the electric staff of the Corporation, said that the work was properly done, and the brickwork was not disturbed. He had laid over 100 electric services in the town, and he never before had any complaint. The brickwork of the house was very old, and he had only to remove a brick with his hand in order to make the hole through which the pipe passed.

Mr. Wm. Beaston (architect), of Dover, and Mr. S. E. Beaufoy, Deputy-Mayor and builder, of the town, also gave evidence for the Corporation, and, in the result,

The jury found for the defendants, after an hour's consideration.

Workmen's Compensation.

His Honour Judge Hugh Sturges, K.C., reserved judgment, in the Preston County Court, last week, in a case in which Mrs. Bessie Gillcade sought to recover compensation from her former employers, Messrs. Dick, Kerr & Co., Ltd., for the loss of the second finger of her right hand. The injury was caused by the limb being caught in the machinery of a gear-box on an adjoining lathe on which she had placed her tea-can. The point was as to whether or not the use of the gear-box for such a purpose was permitted by the firm.

WAR ITEMS.

Ministry of Munitions Tin Order.—The Ministry of Munitions has issued an Order prohibiting the purchase and sale of, or other transaction in, tin situated outside the United Kingdom, except under licence. Except under such licence no tin may be used for the purpose of any manufacture or work except for Class "A" contracts. Monthly returns of tin have to be furnished to the Director of Tin Supplies, 1, Metal Exchange Buildings, E.C. 3.

Demobilisation Plans for Munition Workers. — The National Alliance of Employers and Employed are pressing that plans should be formed for dealing with demobilised munition workers in the same way as demobilised soldiers and sailors, including a month's furlough on full pay, financial help in the case of need, and preventive measures against unemployment.—*Times.*

Reconstruction in Belgium.—In view of the critical situation which will result for Belgium through the disasters caused by the depredation of the enemy, his removing of tools, raw materials, manufactured products, &c., there has been created, with, we are informed, the co-operation of, and under the control of the Belgian State, an organisation having for its object the economical reconstruction of Belgium. It is entitled "Comptoir National pour la Reprise de l'Activite Economique en Belgique" (Société Co-opérative), and its organisation is intended to help industry and trade by enabling them to purchase the tools and all necessary raw materials, and thus not only to reconstruct the economical situation of Belgium, but to put an end to the sufferings of the working classes by enabling them to start working the reconstructed shops. The Comptoir National is inviting English manufacturers and merchants to send catalogues and tariff in triplicate to its offices at 110, Cannon Street, E.C. 4, as it hopes to be in a position later to place contracts for metallurgy, materials for construction of buildings, leathers, textiles, farming implements, chemical products, wood machines, electrical material, optical instruments, motor cars, vans, wagons, oils and greases of all kinds, refractory materials, &c.

Exemption Applications.—The manager and secretary of the Dundee Tramway Carriage Co., Ltd., was granted temporary exemption till August 1st.

At Dover, a review was made of the case of E. W. Wright (40, C 1), electrician. Appellant stated that he was engaged in keeping in repair electrical machinery connected with munition work, and was also installing potato-pulping machinery. He thought he was entitled to a protection certificate. Six months were granted from May 30th.

At Romford, the National Service Representative had a review of the case of T. Holbrook (21), cable vulcaniser, with the Union Cable Co., Ltd., Dagenham Dock. The firm has received a protection certificate from the Munitions Area Dilution Officer, pending the provision of a substitute. The existing conditional exemption was withdrawn.

At Leek, the electrical engineer to the U.D.C. (Mr. Swarbrick) appealed for a fitter's assistant (18), but the Military Representative stated that he could not pass a youth of that age. A month was granted.—The same Tribunal heard a claim by an electrician for his only helper. Applicant said that he and his man both worked day and night, and also on Sundays. He was engaged on important work under the Ministry of Munitions, and had plans for erecting a factory where additional electrical work for the Government could be carried on. It was impossible to carry on the work by himself. Time was granted for inquiries to be made.

At Maidstone, exemption held by J. H. Baxter (31, Grade A), electrician to Messrs. A. E. Reed & Co., of Tovil, has been withdrawn, together with that held by J. P. Macrow (31, Grade A), engaged on the Corporation tramways, as he holds a munition area certificate. The Tribunal has adjourned the case of A. T. Lambert (41, B 1), manager of the Corporation tramways, for him to be regraded, and has given three months to E. Weller (32, B 1), metal turner at the tramway depôt, he to join the Motor Volunteers.

At Eastbourne, Mr. J. K. Brydges, borough electrical engineer, appealing for J. Godden (30, Grade 1), cable jointer and layer, said that his department had been weeded out rather drastically. The appeal was refused, the calling-up being suspended until the middle of May.

At Oxford, the National Service Representative asked for the withdrawal of exemption certificates held by W. J. Hawtin (38, Grade 2), C. W. Millard (37, Grade 2), and A. A. Withey (37, Grade 2), drivers, and T. Smalley (33, Grade 2), foreman driver, all employed by the Electric Tramway Co. Smalley was granted three months, Withey was ordered to report for service by May 1st, and Hawtin and Millard by June 1st. D. Campbell (38, B 1), foreman driver, was appealed for, and was granted three months' exemption.

Appeals were made at Hastings by W. Standen (37, Grade A), overhead linesman with the Tramway Co., and E. Blackford (40, Grade 1), fitter at the tramway power station. The former was directed to report for service by June 7th, and the latter within three weeks.

Herts. Appeal Court heard a one-man business claim put forward by M. J. Connare (38, B 2), electrician, of Watford. He said that he was engaged continuously in the maintenance of motors for electrical plant in factories, workshops, &c. It was urged that he was in a certified occupation. Lady Ebury: He won't be in it long. The Clerk: It really depends upon the grading. Mr. Gape, for the military, said that Grade 3 men who were electricians were wanted in the Army, and they were the only men in that class that he was entitled to ask for. The appeal was respited for re-grading.

At Barnstaple, the Corporation appealed for M. H. Mills (21), the only assistant electrical engineer at the works. Mr. R. E. C. Balsdon said that having regard to the recent combout order, affecting all men between the ages of 19 and 23, they had now to rely solely on the protection certificate of the Munition Area Recruiting Officer. Mr. H. P. Woodcock, National Service Representative, said that this certificate was withdrawn, and the man called up, but the Corporation applied for the case to be re-considered, and the calling-up notice was suspended. Mr. Balsdon said that if the man was taken the result would be disastrous for the town and its industries. Mr. Hadfield, the chief electrical engineer, could not work 24 hours a day continuously. Two men at the works were eligible for military service, and one had just gone. It was intimated that the Munition Area Recruiting Department was making further inquiries concerning the indispensability of Mills, and the appeal was therefore withdrawn.

At Lewes, three months' exemption, subject to substitution, was granted to R. Woodward (27, Class A), shift engineer at the electric light works.

At Chatham, on April 22nd, there was a review of the cases of S. W. A. Mercer (28, A 1), motorman, and F. Ralph (A 1), assistant overhead linesman, engaged with the Tramway Co. It was stated that efforts to find substitutes had been unsuccessful, and the staff of the company was now very low. A committee of the Board of Trade had been appointed to deal with tramway staffs, and it was suggested that the Tribunal should leave the matter with that committee. The Tribunal agreed that conditional exemption should stand, and notice of appeal was given.

At Oswestry, a Military appeal against exemption held by J. T. Jones (27), manager of the electric light works, was dismissed, and the exemption confirmed.

Colchester Tribunal has granted conditional exemption to H. Porter (37), fitter, and A. Pollard (38), shed foreman, engaged at the municipal tramway depôt, and decided that W. L. Barrell (37), painter, should join up by May 9th.

Peterborough Tribunal has granted conditional exemption, on the appeal of the Tramway Co., to E. A. Sewter (32, B 2), and F. Woodman (42, B 2), traffic inspectors, and A. V. Yeomans (24, C 3), car cleaner.

At Grays, exemption was asked for an engine driver at the U.D.C. electricity works (Grade 1), but the appeal was rejected.

BUSINESS NOTES.

Controlled Supply of Accumulators.—In our reference on March 8th (page 227) to the restrictions of the Ministry of Munitions (Priority Branch) our statement of Clause (3) has given rise to some misunderstanding. What it should have conveyed was the following:—In most cases batteries can be renewed up to 75 per cent. of their original capacity under a "Special Battery Permit" which is held by all the leading battery manufacturers, and without further reference to the Priority Department.

Capital Reduction.—On June 11th the High Courts will be asked to confirm a resolution reducing the capital of Pollock and Macnab, Ltd., from £60,000 to £50,000.

C.A.V. Moon Chart. — We are indebted to Messrs. C. A. Vandervell & Co., Ltd., for copies of their "May Moon Chart,"

Nickel Alloys.—The Electrical Alloy Co., of Morristown, New Jersey, have materially increased the capacity of their mills, and are now in a position to dispatch shipments to Great Britain with reasonable promptness. Heretofore, the output of their mills has been mostly absorbed in the States. It is stated that on account of the many inquiries the company have received from Great Britain and the Continent, they contemplate establishing a branch here when "the common enemy is throttled and mankind can breathe peacefully." They have issued a complete catalogue describing the essential nickel alloys and resistance materials, which will be forwarded to interested engineers and manufacturers.

The Australian "Union" Electric.—Under instructions from, and on behalf of, the Controller appointed by the British Board of Trade, the following tenders have been accepted for the electrical plant of the Union Electric Co. of Australia, Ltd.:—Motors, starters, switchgear, M. H. Lauchlan & Co., Sydney; instruments, fans, sundries, Engineering Supply Co. of Australia, Brisbane; carbons, A. Isaacs, Sydney; furniture, Amalgamated Wireless, Ltd.; arcs, Sutherland & Ashman, Melbourne.—*Tenders.*

Trade Announcement.—Messrs. W. L. Davies & A. Soames have granted an exclusive licence to the Equipment and Engineering Co., of 2 and 3, Norfolk Street, Strand, for the use of the "Daysohms" magnetic clutch for electric arc welding machines, which was described in the Electrical Review. Inquiries for welders fitted with this clutch should in future be addressed to the company named. Those for applications of the "Daysohms" clutches, other than arc welding, should be addressed to Messrs. Davies & Soames at Faraday House, 66, Southampton Row, W.C. 1.

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Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—16-page pamphlet, giving illustrations and prices of a selection of different designs of electric light fittings. This has been issued to temporarily take the place of the full catalogue, which is out of print and cannot be re-issued in revised form under prevailing conditions. As our readers may be aware, orders for fittings not actually in stock must be accompanied with a Ministry of Munitions permit. There is, however, quite a demand for the less expensive fittings for Government works and offices. The company holds a fair stock of pre-war fixtures.

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Watson's Water Softeners, Ltd.—This company is winding up voluntarily, with Mr. G. H. L. Volans, 2, Albion Place, Leeds, as liquidator. Meeting of creditors held May 1st.

Book Notices.—*The Engineer's Year-Book for 1918.*—Edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood and Son. Price 25s. net.—It is given to very few men to establish a standard work of reference, to preside over its development, to witness its steady growth in popularity (and bulk!), and to see it attain its twenty-fifth birthday. Our hearty congratulations are, therefore, due to Mr. Kempe on the completion of a quarter of a century of existence by his well-known Year-Book, and on the undoubted success which could alone justify so remarkable a record. The original volume contained some 570 pages; the present issue has been expanded to no fewer than 2,098 pages, an increase of nearly 300 per cent., and contains about 2,000 illustrations. Further, the volume has been produced to all appearances in identically the same style as its predecessors, in spite of the immense difficulties that must have been experienced in achieving this result under war conditions, the severity of which can only be realised by those who come into contact with the printing world, and our congratulations are therefore extended also to the publishers. The contents have, as usual, been fully revised, and new sections have been added, including those on "Fuels: Solid, Liquid, and Gaseous," by Mr. H. Moore; "Mine Valuation," by Prof. H. Louis; "Metallurgy," by Mr. O. W. Ellis; and "Explosives," by Prof. W. R. Hodgkinson. Turning over the pages of this store of engineering information, one realises the impossibility of commenting on the contents of the 40-odd sections; fortunately, it is not necessary, for a work which has triumphantly withstood the fires of criticism for 25 years may confidently be relied upon as a trustworthy guide, and classed "A1."

"The Beama Journal." Volume IV, No. 2. April, 1918. London: King's House, Kingsway. Price 1s. net.

The "M. & C. Apprentices' Magazine" for April, like its forerunners, contains a number of interesting articles—a voyage on a Zeppelin (in 1910), several accounts of the M. and C. camp from different points of view, technical items, and an abundance of house news and notes—and maintains the high standard of excellence to which we have previously drawn attention.

"Post Office Electrical Engineers' Journal." Vol. XI, Part 1. April, 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Scientific Industrial Efficiency." By D. T. Farnham. Brick and Clay Record, Chicago.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI, No. 273. April, 1918. This issue contains the following papers:—"Switchgear Standardisation," by Dr. C. C. Garrard; "Galileo and Magnetism: a Study in Loadstones," by Mr. J. J. Fahie; "The Evolution of the Thermionic Valve," by Mr. R. L. Smith-Rose; also the 15th list containing the names of 38 members on naval and military service.

"Annales des Postes, Télégraphes, et Téléphones." Paris: A. Dumas. Price 12 fr.

LIGHTING AND POWER NOTES.

Armagh.—The Urban Council has refused the Gas Co. permission to erect poles with a view to carrying out an electric lighting scheme, the view of the majority being that such a scheme should be a municipal one.

Australia.—Power Bill.—The Bill that is to be reintroduced before the Victorian Legislative Assembly this session, giving the Railway Commissioners power to install electric mains and distribute electric power, without restriction as to area, is exciting considerable opposition from the Melbourne City Council and the Melbourne Electric Supply Co. On behalf of the present distributors it is pointed out that it would be wasteful to have duplicated reticulations in the same areas, and that, in any case, since the electrified railways are estimated to absorb 48,000 kw. of the 50,000 kw. which the Newport plant is designed to produce, the competition of the Commissioners can only be in the nature of temporarily "picking out the eyes" of, say, the municipality's largest consumers, particularly future consumers. The right of the Commissioners to obtain some financial return from the Newport plant pending its complete utilisation by the railways is not disputed by other local authorities; but it is contended that this purpose can be most usefully and equitably served by Newport supplying its surplus power in bulk to the present local distributing agencies. The views of the various interested parties are at present being represented to the Government. It is somewhat significantly pointed out that if the Railway Commissioners had any earlier intention of catering for the public demand for electricity outside of the railways, they have hardly provided for it in the present plant, which, with its 25-cycle frequency, is not as suitable for power and lighting purposes as the 50-cycle frequency.—*Melbourne Age.*

Stawell B.C. (Vic.) has decided to confer with the Ararat (Vic.) B.C. on the question of a joint scheme to supply both municipalities with electricity generated by water power from the Grampians.

Hamilton T.C. (Queensland) has been notified by the City Electric Co. that the laying of the electric mains within the town would be commenced within three months from the date of the Order in Council and the formal consent to overhead construction. Electrical energy would be available in the town within a month from the commencement of the work.

Sydney City Council has decided (subject to a satisfactory agreement being signed for a period of five years) to give a supply of electrical energy up to the rate of 1,500 kw. to the Commonwealth Steel Products Co., the supply to be taken during May, June, July, and August in each year, at certain fixed hours, at the rate of ·65d. per unit; also, when the supply is available, to give energy, without restriction as to hours, at ·8d. per unit, the prices to be subject to a coal clause. The voltage of the supply is to be approximately 33,000, three-phase, 50 cycles, the demand not to exceed 1,500 kw., with a power factor of not less than ·85, the consumption per annum to be not less than 4,000,000 units. It is stated that the company is purchasing a site for the works on the banks of the Paramatta river.—*Tenders.*

Adelaide.—Price Reduction.—The Electric Supply Co. has reduced the charge for electricity for power between 10 p.m. and 8 p.m., for a consumption up to 5,000 kw. per month, to 1½d. per unit; above this amount per month, ½d. per unit; the tariff is subject to

a slight reduction with the price of coal. These rates are precisely half those ruling for similar consumption during the usual daylight hours.

According to a recent copy of *Tenders*, the Commonwealth Steel Products, Ltd., has purchased the Newcastle Brick and Tile Co.'s works at Waratah, N.S.W., for £13,500. In connection with an electric supply for the company, negotiations have been in progress between the company, the Railway Department, and the Newcastle city electrical engineer. The Railway Department has now notified the Newcastle Corporation that the Commissioners are prepared to take the necessary steps to provide for an additional load of 1,500 KW. within 12 months and of 2,000 KW. in 18 months, the conditions to be subject to the existing arrangement between the Council and the Railway Department.

Bexhill.—PRICE INCREASE.—The Corporation has decided to increase the price of electricity by 10 per cent., making an advance of 25 per cent. on pre-war rates. Prepayment meter rates will be raised from 1s. to 2s. 6d. per quarter.

Braintree.—PROV. ORDER.—The U.D.C. has received a communication from the B. of T. stating that until the reports of the two Parliamentary Committees were received the Board could not proceed with the application for a prov. order for electric lighting, and as those reports could not be received in time for the present session of Parliament, the matter would have to stand over for another year.—*Essex Weekly News.*

Continental.—FRANCE.—The Société des Forces Motrices de Vicors is establishing an electric generating station to utilise the water power of the River Doux at Saint Barthelemy (Ardoche). Four groups of 1,200-H.P. turbines, coupled to three-phase alternators working at 3,800 volts, 50 periods, are being provided for, some of these being already completed and at work. The current generated is stepped up to a pressure of 32,000-35,000 volts, and is transmitted to Tournon, about 4½ miles away.

SWEDEN.—Among the new electricity supply undertakings recently organised in Sweden are the Sodra Vattenkraft Aktiebolag, Jonhoping, to establish a hydro-electric station, and the Aktiebolag Malmtacks Electricitetsverk to establish a central station in the town of Malmtack.

Dublin.—Tuesday, April 23rd, was observed as a day of "Rest" by Irish labour generally, by way of demonstrating the authority of the Unions in a protest against the application of conscription to the country. As a result, most of the electrical works were closed down. In Dublin the Corporation, at the request of the Labour leaders, closed down the works from 6 a.m. to 6 p.m. The "Rest" did not affect Belfast or the north-east towns, where work proceeded as usual. In some towns in the east and south strong complaint was made as to the cutting-off of supplies.

East Ham.—PRICE INCREASE.—The charges for electrical energy subsequent to the meter readings of the June quarter, 1918, and of the tramway undertaking as from April 1st, 1918, are to be as follows:—Private supply: Fixed rate, 4d. per unit, plus 33⅓ per cent.; maximum demand, 5½d. per unit for the maximum demand for one hour per day for 92 days per quarter, and 2½d. per unit for all current in excess of this amount, plus 33⅓d. per cent. Contractors' rate: 2d. per unit, plus 33⅓d. per cent. Power and heating: 1½d. per unit, plus 33⅓ per cent., for first 1,000 units per quarter; 1½d. per unit, plus 33⅓ per cent., subsequent consumption up to 6,000 units per quarter; 1¼d. per unit, plus 33⅓ per cent., 6,000 units and upwards per quarter. Outdoor signs: 2½d. per unit, plus 33⅓ per cent. Arc lamps: Special rates; charge to be increased by ½d. per lamp per hour, plus 33⅓ per cent. Any other special rates in force to be increased ¼d. per unit, plus 33⅓ per cent. Minimum charge to be 3s. per meter per quarter, plus 33⅓ per cent., for private lighting and power supply and 12s. per annum, plus 33⅓ per cent., for heating supply. Traction supply: 1·0625d. per unit, plus 33⅓ per cent.

Edinburgh.—PRICE INCREASE.—The E.L. Committee has recommended that the charges for electricity to private consumers should be 3½d. per unit, an increase of ½d., and for power 1½d., plus 20 per cent., instead of 1¼d.. plus 10 per cent., as at present.

Glasgow.—STREET LIGHTING.—Arrangements are being made for drastic reductions in street lighting, which will amount to about 50 per cent., taking the city as a whole. Lighting will be graduated in accordance with the requirements of traffic; in busy thoroughfares lighting will be less restricted than in suburban districts.

Hornsey.—PRICE INCREASE.—The T.C. has decided from the reading of the meters in June next to make a minimum charge of 6s. 8d. for each of the two summer quarters, and of 13s. 4d. for each of the two winter quarters for electricity supplied.

Ilford.—PRICE INCREASE.—The Electricity Committee has recommended the following revised tariffs, to come into operation from the next reading of the meters:—For residential premises, Rate "A."—12½ per cent. per annum on rateable value, plus 1d. per unit. Both the above charges will be subject to an increase of 50 per cent. Rate "B."—For lighting, 6d. per unit; arc lamps, 5d. per unit. Rate "C."—Maximum demand system, 8d. and 3d. per unit. Rate "D."—Slot meters, 6½d. per unit. For power.—Rate "E" maximum demand system, 4d. and 2d. per unit. Rate "F."—First 500 units per quarter, 4d. per unit; next 1,000 units, 3d. per unit; next 1,000 units, 2½d. per unit; all over 2,500 units per quarter, 2½d. per unit; 10,000 units and over per quarter, 2¼d. per unit. For heating, &c.:—Rate "G."—2½d. per unit. Rates for special purposes:—Kinemas, vehicle charging, photographic lamps, bulk supply, &c., 25 per cent. additional, making total increase 75 per cent. Minimum, 5s. per quarter net.

Kilmarnock.—ANNUAL REPORT.—The report of the year's working of the Corporation electricity department to May 15th, 1917, shows total revenue £33,809, working expenses £17,863, gross profit (including income-tax retained) £16,004, capital charges £9,379, net profit £6,625, as against a profit of £3,342 for 1915-16. From the net profit of £6,625 a sum of £1,000 has been repaid to the gas department on account of various sums advanced during the first few years of the undertaking, leaving a net balance of £5,625. Mr. Bexon, chief electrical engineer, states that during the year 8,373,517 units were sold as compared with 5,026,800 the previous year; the great increase is entirely due to the rapid development of the power load, of the full output 87·8 per cent. is for energy used by consumers under agreements varying in periods from five to 13 years. An increase of 1,693,696 units has been obtained from the Burgh of Kilmarnock, and from the outer burghs an increase of 1,653,021 units over the previous year. In the eastern area a large number of mills have been connected during the year, but, owing to Government restrictions, many of the remaining mills not employed on Government work which would have taken the supply have been unable to obtain the necessary motors and material. In the Irvine districts it can be safely stated that all the large works now take the supply from the department, and in the City Council area three coal pits have been electrified chiefly for pumping purposes during the year, and a number of farms have taken the supply for agricultural purposes. Total works costs per unit ·512d., as against ·585d., which is the same figure as was obtained for 1914-15. Average price of coal per ton in 1915 4s. 2d., 1916-17 10s. 10d. Load factor 29·60, as compared with 24·28; maximum load 3,250 KW., as against 2,400 KW.; 707 motors connected, with a total of 8,887 H.P.

Manchester.—RATE AID.—The Electricity Committee has been able to allocate £16,570 for rate aid, and also £1,996 for special expenditure for which borrowing powers were not obtainable, and to carry £6,469 to reserve fund. The departmental year closed with a surplus of £8,465, instead of a deficit of £10,570. During the coming year the rate aid, fixed by the Council at 1 per cent. on capital outlays, will absorb £33,400, or more than double last year's contribution.

Nelson.—YEAR'S WORKING.—There was a loss on the working of the electricity undertaking for the past year of £1,987.

Newcastle-on-Tyne.—A conference of representatives of municipalities in the North-East of England was held in Newcastle on April 26th, to consider the report of the Coal Conservation Sub-Committee, and it was discussed at length in private. The conference agreed that the manufacture of electrical energy for public utility purposes should be under public control. The following resolution was also adopted:—"That this conference, whilst recognising that the unification, production, and distribution of electrical energy over areas sufficiently large and carefully defined is desirable, does not endorse the recommendations in the report of the Coal Conservation Sub-Committee, and agrees to appoint a Committee to consider that report, and prepare a reasoned statement in relation thereto."

Shropshire Power Co.'s Bill.—The Shropshire, Worcestershire, and Staffordshire Bill was further considered by Lord Muir Mackenzie's Committee of the House of Lords last week. Mr. V. Knox, who appeared for the Corporation of Wolverhampton and Smethwick, asked for the insertion of a clause which provided that the Shropshire Co. should not, during the continuance of the present war, or for two years afterwards, exercise in the northern area, or any part thereof, any powers they possessed under the Act of 1913, or this Act, and that nothing contained in this Act should prejudice any application which might be made by a public body authorised by Parliament to supply electricity for the cesser or revocation of the company's power. Mr. Lloyd, for the company, said the clause would make the position of the Shropshire Co. impossible; it would exclude them from the whole county of Stafford and the greater part of the county of Worcester. One of the main objects of the Bill was to enable the promoters to link-up with Birmingham. Lord Muir Mackenzie said the Committee was of opinion that the Shropshire Co., pending the introduction of a great scheme for the supply of electric power in the district, should not be allowed to penetrate into the northern area. The decision would not affect any district where the Shropshire Co. were now supplying electricity.

At the resumed sitting, Mr. Charteris, on behalf of the promoters, said the parties had practically agreed upon a clause to carry out their Lordships' decision. The clause was substantially the same as was submitted by Mr. Knox, the only difference being in regard to a sub-section which provided that the company should not, except by direction of the Ministry of Munitions, with the consent of the Midland Electric Corporation for Power Distribution, or in the Boroughs of Walsall, Wolverhampton, and W. Bromwich, with the consent of the local authorities thereof respectively, during the continuation of the present war, and for two years thereafter, supply electricity in the area in the section defined, or in any part thereof, to any authority, company, or person not supplied by the company on April 25th, 1918.

The Committee agreed with the clause as handed in, and the Bill, having passed the Committee stage, was ordered to be reported to the House of Lords for third reading.

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Prentice Wireless Train Control, Ltd.—A meeting is to be held on June 3rd, at 5, Broad Street Place, E.C. 2, to hear an account of the winding up from the liquidator, Mr. F. V. Royce.

Watson's Water Softeners, Ltd.—This company is winding up voluntarily, with Mr. G. H. L. Volans, 2, Albion Place, Leeds, as liquidator. Meeting of creditors held May 1st.

Book Notices.—*The Engineer's Year-Book for 1918.*—Edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood and Son. Price 25s. net.—It is given to very few men to establish a standard work of reference, to preside over its development, to witness its steady growth in popularity (and bulk!), and to see it attain its twenty-fifth birthday. Our hearty congratulations are, therefore, due to Mr. Kempe on the completion of a quarter of a century of existence by his well-known Year-Book, and on the undoubted success which could alone justify so remarkable a record. The original volume contained some 570 pages; the present issue has been expanded to no fewer than 2,098 pages, an increase of nearly 300 per cent., and contains about 2,000 illustrations. Further, the volume has been produced to all appearances in identically the same style as its predecessors, in spite of the immense difficulties that must have been experienced in achieving this result under war conditions, the severity of which can only be realised by those who come into contact with the printing world, and our congratulations are therefore extended also to the publishers. The contents have, as usual, been fully revised, and new sections have been added, including those on "Fuels: Solid, Liquid, and Gaseous," by Mr. H. Moore; "Mine Valuation," by Prof. H. Louis; "Metallurgy," by Mr. O. W. Ellis; and "Explosives," by Prof. W. R. Hodgkinson. Turning over the pages of this store of engineering information, one realises the impossibility of commenting on the contents of the 40-odd sections; fortunately, it is not necessary, for a work which has triumphantly withstood the fires of criticism for 25 years may confidently be relied upon as a trustworthy guide, and classed "A1."

"The Beama Journal." Volume IV, No. 2. April, 1918. London: King's House, Kingsway. Price 1s. net.

The "M. & C. Apprentices' Magazine" for April, like its forerunners, contains a number of interesting articles—a voyage on a Zeppelin (in 1910), several accounts of the M. and C. camp from different points of view, technical items, and an abundance of house news and notes—and maintains the high standard of excellence to which we have previously drawn attention.

"Post Office Electrical Engineers' Journal." Vol. XI, Part 1. April, 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Scientific Industrial Efficiency." By D. T. Farnham. Brick and Clay Record, Chicago.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI, No. 273. April, 1918. This issue contains the following papers:—"Switchgear Standardisation," by Dr. C. C. Garrard; "Galileo and Magnetism: a Study in Loadstones," by Mr. J. J. Fahie; "The Evolution of the Thermionic Valve," by Mr. R. L. Smith-Rose; also the 15th list containing the names of 38 members on naval and military service.

"Annales des Postes, Télégraphes, et Téléphones." Paris: A. Dumas. Price 12 fr.

LIGHTING AND POWER NOTES.

Armagh.—The Urban Council has refused the Gas Co. permission to erect poles with a view to carrying out an electric lighting scheme, the view of the majority being that such a scheme should be a municipal one.

Australia.—Power Bill.—The Bill that is to be reintroduced before the Victorian Legislative Assembly this session, giving the Railway Commissioners power to install electric mains and distribute electric power, without restriction as to area, is exciting considerable opposition from the Melbourne City Council and the Melbourne Electric Supply Co. On behalf of the present distributors it is pointed out that it would be wasteful to have duplicated reticulations in the same areas, and that, in any case, since the electrified railways are estimated to absorb 48,000 kw. of the 50,000 kw. which the Newport plant is designed to produce, the competition of the Commissioners can only be in the nature of temporarily "picking out the eyes" of, say, the municipality's largest consumers, particularly future consumers. The right of the Commissioners to obtain some financial return from the Newport plant pending its complete utilisation by the railways is not disputed by other local authorities; but it is contended that this purpose can be most usefully and equitably served by Newport supplying its surplus power in bulk to the present local distributing agencies. The views of the various interested parties are at present being represented to the Government. It is somewhat significantly pointed out that if the Railway Commissioners had any earlier intention of catering for the public demand for electricity outside of the railways, they have hardly provided for it in the present plant, which, with its 25-cycle frequency, is not as suitable for power and lighting purposes as the 50-cycle frequency.—*Melbourne Age.*

Stawell B.C. (Vic.) has decided to confer with the Ararat (Vic.) B.C. on the question of a joint scheme to supply both municipalities with electricity generated by water power from the Grampians.

Hamilton T.C. (Queensland) has been notified by the City Electric Co. that the laying of the electric mains within the town would be commenced within three months from the date of the Order in Council and the formal consent to overhead construction. Electrical energy would be available in the town within a month from the commencement of the work.

Sydney City Council has decided (subject to a satisfactory agreement being signed for a period of five years) to give a supply of electrical energy up to the rate of 1,500 kw. to the Commonwealth Steel Products Co., the supply to be taken during May, June, July, and August in each year, at certain fixed hours, at the rate of '65d. per unit; also, when the supply is available, to give energy, without restriction as to hours, at '8d. per unit, the prices to be subject to a coal clause. The voltage of the supply is to be approximately 33,000, three-phase, 50 cycles, the demand not to exceed 1,500 kw., with a power factor of not less than '85, the consumption per annum to be not less than 4,000,000 units. It is stated that the company is purchasing a site for the works on the banks of the Paramatta river.—*Tenders.*

Adelaide.—Price Reduction.—The Electric Supply Co. has reduced the charge for electricity for power between 10 p.m. and 8 p.m., for a consumption up to 5,000 kw. per month, to 1½d. per unit; above this amount per month, ¾d. per unit; the tariff is subject to

a slight reduction with the price of coal. These rates are precisely half those ruling for similar consumption during the usual daylight hours.

According to a recent copy of *Tenders*, the Commonwealth Steel Products, Ltd., has purchased the Newcastle Brick and Tile Co.'s works at Waratah, N.S.W., for £13,500. In connection with an electric supply for the company, negotiations have been in progress between the company, the Railway Department, and the Newcastle city electrical engineer. The Railway Department has now notified the Newcastle Corporation that the Commissioners are prepared to take the necessary steps to provide for an additional load of 1,500 KW. within 12 months and of 2,000 KW. in 18 months, the conditions to be subject to the existing arrangement between the Council and the Railway Department.

Bexhill.—PRICE INCREASE.—The Corporation has decided to increase the price of electricity by 10 per cent., making an advance of 25 per cent. on pre-war rates. Prepayment meter rates will be raised from 1s. to 2s. 6d. per quarter.

Braintree.—PROV. ORDER.—The U.D.C. has received a communication from the B. of T. stating that until the reports of the two Parliamentary Committees were received the Board could not proceed with the application for a prov. order for electric lighting, and as those reports could not be received in time for the present session of Parliament, the matter would have to stand over for another year.—*Essex Weekly News.*

Continental.—FRANCE.—The Société des Forces Motrices de Vicors is establishing an electric generating station to utilise the water power of the River Doux at Saint Barthelemy (Ardoche). Four groups of 1,200-H.P. turbines, coupled to three-phase alternators working at 3,800 volts, 50 periods, are being provided for, some of these being already completed and at work. The current generated is stepped up to a pressure of 32,000-35,000 volts, and is transmitted to Tournon, about 4½ miles away.

SWEDEN.—Among the new electricity supply undertakings recently organised in Sweden are the Sodra Vattenkraft Aktiebolag, Jonhoping, to establish a hydro-electric station, and the Aktiebolag Malmtacka Electricitetsverk to establish a central station in the town of Malmtack.

Dublin.—Tuesday, April 23rd, was observed as a day of "Rest" by Irish labour generally, by way of demonstrating the authority of the Unions in a protest against the application of conscription to the country. As a result, most of the electrical works were closed down. In Dublin the Corporation, at the request of the Labour leaders, closed down the works from 6 a.m. to 6 p.m. The "Rest" did not affect Belfast or the north-east towns, where work proceeded as usual. In some towns in the east and south strong complaint was made as to the cutting-off of supplies.

East Ham.—PRICE INCREASE.—The charges for electrical energy subsequent to the meter readings of the June quarter, 1918, and of the tramway undertaking as from April 1st, 1918, are to be as follows:—Private supply: Fixed rate, 4d. per unit, plus 33⅓ per cent.; maximum demand, 5½d. per unit for the maximum demand for one hour per day for 92 days per quarter, and 2½d. per unit for all current in excess of this amount, plus 33⅓d. per cent. Contractors' rate: 2d. per unit, plus 33⅓d. per cent. Power and heating: 1½d. per unit, plus 33⅓ per cent., for first 1,000 units per quarter; 1½d. per unit, plus 33⅓ per cent., subsequent consumption up to 6,000 units per quarter; 1½d. per unit, plus 33⅓ per cent., 6,000 units and upwards per quarter. Outdoor signs: 2½d. per unit, plus 33⅓ per cent. Arc lamps: Special rates; charge to be increased by ½d. per lamp per hour, plus 33⅓ per cent. Any other special rates in force to be increased ½d. per unit, plus 33⅓ per cent. Minimum charge to be 3s. per meter per quarter, plus 33⅓ per cent., for private lighting and power supply and 12s. per annum, plus 33⅓ per cent., for heating supply. Traction supply: 1·0625d. per unit, plus 33⅓ per cent.

Edinburgh.—PRICE INCREASE.—The E.L. Committee has recommended that the charges for electricity to private consumers should be 3½d. per unit, an increase of ½d., and for power 1½d., plus 20 per cent., instead of 1½d., plus 10 per cent., as at present.

Glasgow.—STREET LIGHTING.—Arrangements are being made for drastic reductions in street lighting, which will amount to about 50 per cent., taking the city as a whole. Lighting will be graduated in accordance with the requirements of traffic; in busy thoroughfares lighting will be less restricted than in suburban districts.

Hornsey.—PRICE INCREASE.—The T.C. has decided from the reading of the meters in June next to make a minimum charge of 6s. 8d. for each of the two summer quarters, and of 13s. 4d. for each of the two winter quarters for electricity supplied.

Ilford.—PRICE INCREASE.—The Electricity Committee has recommended the following revised tariffs, to come into operation from the next reading of the meters:—For residential premises, Rate "A."—12½ per cent. per annum on rateable value, plus 1d. per unit. Both the above charges will be subject to an increase of 50 per cent. Rate "B."—For lighting, 6d. per unit; arc lamps, 5d. per unit. Rate "C."—Maximum demand system, 8d. and 3d. per unit. Rate "D."—Slot meters, 6½d. per unit. For power.—Rate "E" maximum demand system, 4d. and 2d. per unit. Rate "F."—First 500 units per quarter, 4d. per unit; next 1,000 units, 3d. per unit; next 1,000 units, 2½d. per unit; all over 2,500 units per quarter, 2½d. per unit; 10,000 units and over per quarter, 2½d. per unit. For heating, &c.:—Rate "G."—2½d. per unit. Rates for special purposes:—Kinemas, vehicle charging, photographic lamps, bulk supply, &c., 25 per cent. additional, making total increase 75 per cent. Minimum, 5s. per quarter net.

Kilmarnock.—ANNUAL REPORT.—The report of the year's working of the Corporation electricity department to May 15th, 1917, shows total revenue £33,809, working expenses £17,863, gross profit (including income-tax retained) £16,004, capital charges £9,379, net profit £6,625, as against a profit of £3,342 for 1915-16. From the net profit of £6,625 a sum of £1,000 has been repaid to the gas department on account of various sums advanced during the first few years of the undertaking, leaving a net balance of £5,625. Mr. Bexon, chief electrical engineer, states that during the year 8,373,517 units were sold as compared with 5,026,800 the previous year; the great increase is entirely due to the rapid development of the power load, of the full output 87·8 per cent. is for energy used by consumers under agreements varying in periods from five to 13 years. An increase of 1,693,696 units has been obtained from the Burgh of Kilmarnock, and from the outer burghs an increase of 1,653,021 units over the previous year. In the eastern area a large number of mills have been connected during the year, but, owing to Government restrictions, many of the remaining mills not employed on Government work which would have taken the supply have been unable to obtain the necessary motors and material. In the Irvine districts it can be safely stated that all the large works now take the supply from the department, and in the City Council area three coal pits have been electrified chiefly for pumping purposes during the year, and a number of farms have taken the supply for agricultural purposes. Total works costs per unit ·512d., as against ·585d., which is the same figure as was obtained for 1914-15. Average price of coal per ton in 1915 4s. 2d., 1916-17 10s. 10d. Load factor 29·60, as compared with 24·28; maximum load 3,250 KW., as against 2,400 KW.; 707 motors connected, with a total of 8,887 H.P.

Manchester.—RATE AID.—The Electricity Committee has been able to allocate £16,570 for rate aid, and also £1,996 for special expenditure for which borrowing powers were not obtainable, and to carry £6,469 to reserve fund. The departmental year closed with a surplus of £8,465, instead of a deficit of £10,570. During the coming year the rate aid, fixed by the Council at 1 per cent. on capital outlays, will absorb £33,400, or more than double last year's contribution.

Nelson.—YEAR'S WORKING.—There was a loss on the working of the electricity undertaking for the past year of £1,987.

Newcastle-on-Tyne.—A conference of representatives of municipalities in the North-East of England was held in Newcastle on April 26th, to consider the report of the Coal Conservation Sub-Committee, and it was discussed at length in private. The conference agreed that the manufacture of electrical energy for public utility purposes should be under public control. The following resolution was also adopted:—"That this conference, whilst recognising that the unification, production, and distribution of electrical energy over areas sufficiently large and carefully defined is desirable, does not endorse the recommendations in the report of the Coal Conservation Sub-Committee, and agrees to appoint a Committee to consider that report, and prepare a reasoned statement in relation thereto."

Shropshire Power Co.'s Bill.—The Shropshire, Worcestershire, and Staffordshire Bill was further considered by Lord Muir Mackenzie's Committee of the House of Lords last week. Mr. V. Knox, who appeared for the Corporation of Wolverhampton and Smethwick, asked for the insertion of a clause which provided that the Shropshire Co. should not, during the continuance of the present war, or for two years afterwards, exercise in the northern area, or any part thereof, any powers they possessed under the Act of 1913, or this Act, and that nothing contained in this Act should prejudice any application which might be made by a public body authorised by Parliament to supply electricity for the cesser or revocation of the company's power. Mr. Lloyd, for the company, said the clause would make the position of the Shropshire Co. impossible; it would exclude them from the whole county of Stafford and the greater part of the county of Worcester. One of the main objects of the Bill was to enable the promoters to link-up with Birmingham. Lord Muir Mackenzie said the Committee was of opinion that the Shropshire Co., pending the introduction of a great scheme for the supply of electric power in the district, should not be allowed to penetrate into the northern area. The decision would not affect any district where the Shropshire Co. were now supplying electricity.

At the resumed sitting, Mr. Charteris, on behalf of the promoters, said the parties had practically agreed upon a clause to carry out their Lordships' decision. The clause was substantially the same as was submitted by Mr. Knox, the only difference being in regard to a sub-section which provided that the company should not, except by direction of the Ministry of Munitions, with the consent of the Midland Electric Corporation for Power Distribution, or in the Boroughs of Walsall, Wolverhampton, and W. Bromwich, with the consent of the local authorities thereof respectively, during the continuation of the present war, and for two years thereafter, supply electricity in the area in the section defined, or in any part thereof, to any authority, company, or person not supplied by the company on April 25th, 1918.

The Committee agreed with the clause as handed in, and the Bill, having passed the Committee stage, was ordered to be reported to the House of Lords for third reading.

Rawtenstall.—Plant Extensions.—At the Corporation electricity works, a few days ago, the Mayor started a new turbo-alternator, which will increase the output from five million to seven million units, the total cost of the work being £9,760, which is being paid out of the revenue. The new installation raises the capacity of the Hareholme works from 4,400 H.P. to 7,500 H.P.

Rochdale.—Year's Working.—The result of the past year's working of the electricity department of the Corporation is a deficiency of £3,674, which, added to a debit balance of £6,036 brought forward, leaves a total deficit of £9,710. This amount is to be taken from the depreciation fund, which will now be reduced to less than £200. This proposal is being made to avoid an increase of 6d. in the rates, which, apart from this, are to go up from 9s. 6d. to 10s. 9d. The income of the electricity undertaking was £74,341, an increase of £12,306, whilst the working expenses (£54,302) were lower by £269. The gross profits were £20,038, an increase of £12,238. Interest and sinking-fund charges were £19,562, depreciation £2,495, and half wages and bonuses make up the difference.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Fare Revision.—The revised tramway fares on the Corporation electric tramways came into operation on Monday, last week. The first 1d. stages are, on the average, a mile and a quarter in length, and the other stages on the routes are shortened accordingly. The general effect is an increase of ½d. on the longer journeys. The Tramways Committee claims that, with the increased fares, Birmingham compares favourably with other cities and towns, some of which have adopted a minimum fare of 1½d., and have no overlapping stages. The Committee is not compelled under its statutory obligations to carry ordinary passengers more than a mile for 1d.; but there is a direction to carry workmen, at specified times, two miles for the 1d. fare. In view of the increased cost of running the tramway system, the City Council has asked the Board of Trade to consent to a removal of this obligation. Children's fares have also been revised—the minimum is 1d.

Bolton.—Rate Aid.—The Tramways Committee has decided to transfer £15,500 in aid of rates, the amount estimated at the beginning of the year, and has also agreed to estimate for a similar sum as profit in aid of rates for the year ending next March.

Bristol.—Strike.—The *Times* states that the tramway services were partly suspended, on Tuesday last week, by a strike involving the question of the employment of non-Unionists.

On April 26th the men resolved to resume work, pending negotiations between the Transport Workers' Federation and the company.

Burnley.—Fare Revision.—The Tramways Committee has decided to recommend the Town Council to adopt increases of tramway fares from June 1st. School children at present using discount tickets will be affected by the alterations, and a number of transfer tickets are to be abolished.

Cardiff.—Economy.—The Corporation Tramway Department appreciates the scarcity of paper. All scrap is returned to the firm supplying the tickets, while the sweepings of the cars are riddled, put in bags, and returned to the paper mills.

Continental.—Germany.—Three electric locomotives of a new type have recently been put in service for goods traffic on the Magdeburg-Leipzig-Halle section of the German State Railways. The machines are of 1,200 H.P., and are designed to work with alternating current at 13,500 volts, 16⅔ periods per second, each locomotive being equipped with a couple of motors. The locomotives were built by the Allgemeine Electricitäts Gesellschaft, Berlin, which has also 27 more of the same type in course of construction for goods train haulage.

The *Evening News* states that all the tramways and omnibuses in Budapest have ceased to run.

Cork.—Wages.—The Tramway Co.'s employés' wages demand has been settled by negotiation, thus averting a threatened strike.

Dublin.—Fare Increase.—A revised list of fares on the United Tramway Co.'s lines came into operation recently. Its effect generally is an increase of ½d. on the overlapping stages, which means that most of the 1d. stages are now 1½d., but some of the 1d. fares remain the same. Special through cars to outlying places have been withdrawn, as also have season tickets.

Wages.—Mr. J. H. Baillie, arbitrator in regard to the United Tramway Co.'s employés' application for a 20s. advance on pre-war rates, has decided on 5s. increase for men whose aggregate advances since the war do not exceed 15s. over pre-war rates, and an increase to produce 20s. over pre-war rates for men in the power-station, overhead department, and Ballsbridge works whose increases since the war are in excess of 15s. but less than 20s., the advances not to apply to traffic, motor, or ticket inspectors, timekeepers, tradesmen at Ballsbridge, the cable department, or workmen at the Inchicore works.

Halifax.—Wages.—The Tramways and Electricity Committee has appointed a Special Sub-Committee to consider the scale of pay, &c., now in force for inspectors, motormen, and conductors in the Tramways Department, and to report.

Heywood.—Year's Working.—The year's working of the Corporation tramways has resulted in a profit of £502, as compared with a loss of £783 for the previous year.

Kilmarnock.—Year's Working.—The report of the burgh tramway undertaking for the year ended May 15th, 1917, shows total revenue, £9,200; operating expenses, £8,048; gross profit, £1,152; after deducting sinking-fund and interest charges and allowing £1,160 for depreciation, there is a net deficit of £3,163, as against a deficit of £3,064 in 1915-16. Average total revenue per car-mile, 9·23d.; average operating expenses per car-mile, including power cost, 8·073d. Number of passengers carried, 2,483,155; car-mileage, 239,296—an increase of 71,068 passengers and a decrease of 36,053 miles.

Leeds.—Fare Revision.—It is announced that some misunderstanding has arisen in regard to the proposed revised tramway fares. The idea got abroad that ½d. fares were to be entirely abolished, but it is stated by the department that the end of the ½d. fare applies only on the existing first two ½d. stages from the centre of the city.

Leyton.—Electric Vans.—The U.D.C. is pressing upon the Government department concerned, as a matter of urgency, a request for authority to purchase two electric dust vans.

Liverpool.—Year's Working.—Compared with pre-war times, the traffic on the tramways during 1917, according to the manager's statement published on Monday, shows an increase of 40 million passengers. Causes are to be found in the diversions from railway traffic, munition workers, and the port's shipping activity. The year's revenue was £845,645, yielding a gross profit of £270,000, of which £125,000 goes to the relief of the rates.

London.—L.U.T.—According to the *Evening News*, the proposal to abandon portions of the London United Tramway system has been dropped.

Manchester.—Fare Increase.—The Tramways Committee has decided to ask the City Council for leave to revise the passenger fares as follows:—Halfpenny stages on circular and other routes to be abolished, and the minimum fares on such routes to be 1d.; workmen's fares to be abolished on all routes, and every class of passenger called upon to pay ordinary fares; a new scale to be adopted of approximately two miles for 1d. from the centre of the city; corresponding increase as regards 1½d., 2d., and higher fares and stages; fares of children up to 14 years of age to remain as at present, namely, half fares. The statutory requirement is to carry workpeople two miles for 1d., whereas at present in Manchester the workpeople's stages average about 3½ miles for 1d. The Committee state that it is compelled to make these changes because of the City Council's demand for a contribution of £111,890 in aid of the rates, and the several heavy charges in respect of war bonuses, service allowances, &c., amounting in the aggregate to £319,745.

Nelson.—Year's Working.—The light railway undertaking shows a net profit on the year of £615.

Northampton.—Sunday Service.—The Tramways Committee has decided to cease running tramway-cars on Sundays, and to stop them half-an-hour earlier on week-days.

Preston.—Purchase of Cars.—The Town Council has adopted the recommendation of the Tramways Committee to purchase six additional single-decked cars from the Sheffield Corporation, at a cost of £350 each. Alderman Ormrod stated that there was a big increase in traffic, over 44,000 more passengers being carried the other week, as compared with the corresponding period of last year, and the new cars would be of very great service.

Southend.—Fare Increase.—The *Evening News* says that, commencing May 1st, all fares on the Corporation tramways will be increased by 75 per cent.

Tramway Charges.—Last week the House of Commons appointed a Select Committee to consider and report whether it is expedient that some provision should be made for the temporary modification of statutory requirements with regard to the charges for the conveyance of traffic on tramways and light railways constructed wholly, or mainly, on public roads, in the case of undertakings whose financial circumstances have been injuriously affected by causes arising out of the war. The following are the names of the members of the Committee:—Capt. Barnett, Sir J. Boyton, Mr. Broughton, Mr. Cochrane, Sir A. Fell, Mr. Nugent, Sir W. Pearce, Mr. Rendall, Mr. Tootill, and Mr. Watt.

Whitley and Monkseaton.—At a meeting of the District Council it was stated that the Tynemouth Corporation was considering the question of the local tramways in view of the fact that the lease with the present company was approaching its termination, and a joint conference was suggested. It was decided that the Tynemouth Corporation be asked to meet the District Council in Committee.

TELEGRAPH AND TELEPHONE NOTES.

Delivery of Telegrams.—Notice is given in the *London Gazette* of the issue of regulations relating to special instructions as to the delivery of telegrams, which come into force on June 1st, 1918.

South America.—The Brazilian Government has authorised the Western Union Telegraph Co. to lay two cables from Rio de Janeiro to other Brazilian ports. One is to extend northward to Belem or Para, which is located on the Para River, 80 miles from the Atlantic Ocean. This cable will be approximately 3,500 miles in length. The other line will extend from Rio to Paranaqua, a maritime town about 650 miles down the coast. It is expected that the Rio-Belem cable will be extended to the Antilles.

The extension of cable landing rights to the Western Union Telegraph Co. has been a subject of negotiation for several months between the company and the Brazilian Government. These rights heretofore have been held exclusively by British companies. As it is impossible to obtain cable either in the United States or abroad, actual construction of the two new lines probably will not be begun until after the war.—*T. and T. Age.*

United States.—The main purpose of the Pan-American Wireless Telegraph and Telephone Co., which was organised in New York recently, is to connect the United States with all the countries of South and Central America, and the West Indian Islands, by wireless telegraphy. It will begin with Argentina, where the arrangements with the Government have been concluded, and its technical experts are arranging for suitable sites, so that the high-power stations and their necessary equipment can be completed and ready for service within the next 12 months. The work will afterwards be taken up in Brazil, and then in the other States successively, and as rapidly as the necessary arrangements can be made. Mexico will be included in the system. Wireless stations, more powerful and complete than any heretofore constructed, will be erected in each of the principal trade centres of the various countries, and will be able to carry on a 24-hour commercial telegraph service with New York. Messages intended for Europe will be sent either directly or through the trans-Atlantic wireless service of the Marconi Wireless Telegraph Co. of America, making connections with Great Britain, France, Spain, Italy, Russia and Scandinavia; and, from the Pacific Coast—San Francisco, Cal.—wireless connections will be made, through Hawaii, with Japan and the Orient. In the United States the system will connect with the land lines of the Western Union Telegraph Co. This greatly improved service will be accompanied by a substantial reduction of rates.

The fulfilment of this comprehensive programme will be greatly facilitated by the adoption of the latest inventions in wireless telegraphy, including the patents and improvements of the American and English Marconi Companies and the Danish Poulsen-Pedersen system. The new company is in a very strong financial position, with abundant resources for the carrying-out of its great undertaking. No stock is offered for sale. The president, Mr. Edward J. Nally, is also vice-president and general manager of the Marconi Wireless Telegraph Co. of America.

The Western Union Telegraph Co., at the end of 1917, had 199,473 miles of pole line, 1,599,377 miles of wire, 2,875 miles of land line cables, and 22,915 n. miles of ocean cables, with 25,466 offices in operation. The traffic was unprecedented, showing an increase of 66 per cent. over 1914.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

BRISBANE.—July. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary, the Treasury, Brisbane.

Glasgow.—May 7th. Cleansing Department. Six months' supply of electrical material. Mr. W. Greig, Superintendent, 20, Trongate.

Hoylake and West Kirby.—May 11th. Supply, &c., for one year to March 31st, 1919, of metallic filament lamps. Particulars from R. Williams, Clerk to Council, Town Hall, Hoylake.

Leith.—May 6th. Electricity Committee. Six or 12 months' supply (9,000 and 18,000 tons) of washed singles. Burgh Electrical Engineer.

London.—ISLINGTON.—May 24th. Lighting Committee. 5,000-KW. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

H.M. Office of Works. May 10th. Supply of main switches. See "Official Notices" to-day.

Redditch.—May 13th. U.D.C. Turbo-alternator, cooling tower, switchgear, water-tube boiler, &c. See "Official Notices," April 26th.

Spain.—Municipal authorities of Villarramiel (Province of Palencia). Tenders for the concession for the electric lighting of the town during 15 years.

Warrington.—May 22nd. Electricity and Tramways Committee. Motors and transformers. See "Official Notices" to-day.

CLOSED.

Ilford.—U.D.C. Fuller Wire & Cable Co., Ltd. 150 yd. 61/12, 600-volt cable. £125.

Spain.—La Sociedad Energia Electrica de Cataluna has recently placed a contract with Messrs. Escher, Wyss & Co., of Zurich, for three Pelton turbines for its new hydro-electric station near Capdella, in the Pyrenees. Each of the turbines will be of 6,700 H.P., when running at a speed of 375 revs. per minute.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on the paper "Employment of Women in Munition Factories."

Junior Institution of Engineers.—Friday, May 3rd. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Power Plants: National, Communal, or Industrial," by Mr. W. A. Tookey.

Saturday, May 11th. At 3 p.m. At the Holborn Restaurant (Venetian Chamber). Annual Bohemian Concert.

(North-Eastern Section.)—Tuesday, May 7th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "Critical Speeds of Shafts," by Mr. G. Bonner.

Association of Mining Electrical Engineers (West of Scotland Branch).—Monday, May 6th. At 4.30 p.m. At the Royal Technical College, George Street, Glasgow. Paper on "Organisation of Electrical Repairs," by Mr. J. McCann. Annual meeting.

Roentgen Society.—Tuesday, May 7th. At 7.45 p.m. At the Royal Society of Arts. General meeting.

Faraday Society.—Tuesday, May 7th. At 5.30 p.m. At Burlington House, Piccadilly, W. 1. Discussion on "The Co-ordination of Scientific Publication," to be opened by Sir Robert Hadfield, F.R.S.

Salford Technical and Engineering Association.—Wednesday, May 8th. At 7 p.m. Visit to Messrs. Mitchell, Shackleton & Co., Ltd., Vulcan Works, Patricroft.

Institution of Electrical Engineers.—Thursday, May 9th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on "A British Electrical Proving House," with an introductory paper by Mr. C. Turnbull.

(Newcastle Local Section).—Monday, May 6th. At 6.45 p.m. At the Mining Institute. Informal discussion on "The Proposed Regulations for the Electrical Equipment of Ships;" to be opened by Mr. A. P. Pyne.

(Scottish Local Section).—Tuesday, May 7th. At 7.30 p.m. At 207, Bath Street, Glasgow. Informal discussion on "The Proposed Regulations for Electrical Equipment of Ships," to be opened by Mr. J. F. Nielson.

Electrical Power Engineers' Association (Midland Section).—Friday, May 10th. At the Imperial Hotel, Temple Street, Birmingham. At 7.30 p.m. Smoking Concert.

London Association of Foremen Engineers.—Saturday, May 11th. At 6 p.m. At Cannon Street Hotel, E.C. Sixty-fifth Anniversary Festival.

NOTES.

The Lochaber Water Power Bill.—In the House of Lords, on Tuesday, Lord Balfour moved the rejection of the British Aluminium Co. (Lochaber Water Power) Bill. After discussion, the motion for the second reading of the Bill was by leave withdrawn.

Wages Award.—The Committee on Production, to which the Ministry of Labour referred a claim by the staff employés of the General Electric Co., Ltd., Witton, for payment of the 12½ per cent. bonus on earnings, has issued an award in favour of the employés. The Committee's decision is that having regard to the cases in which the sanction of the Ministry of Munitions has been given to the grant of the bonus of 12½ per cent. on earnings to members of clerical staffs, a bonus of that amount shall be given to men concerned in this claim, to date as from the beginning of the first full pay-day following the date of the award, such bonus to be limited to £31 5s. per annum—viz., 12½ per cent. on the first £250.

London (E.T.U.) Station Engineers' Concert.—The first annual concert of the London Station Engineers' Branches of the Electrical Trades Union was held on April 24th at the Horns, when a first-class programme was produced. We are informed that the hall was packed with representatives of all branches of the trade. During the evening a presentation of a bureau, bookcase, and an illuminated address was made to Mr. H. H. Morton, secretary of No. 1 Branch, for his strenuous and successful efforts to ameliorate the position and improve the status of the station engineer. The president observed that, whereas in November, 1916, only one branch had been formed in London, to-day eight other branches were necessary to cope with the increasing membership. Mr. Morton, in replying, thanked the members for the handsome appreciation of his efforts, and hoped the day was not far off when the present division amongst station men would disappear, as the outcome of mutual toleration, when he anticipated that a common basis for united effort would be found. The concert arrangements were in the hands of Mr. Belcher.

British Scientific Products Exhibition.—The British Science Guild is organising a comprehensive exhibition of products and appliances of scientific and industrial interest which, prior to the war, were obtained chiefly from enemy countries but are now produced in the United Kingdom. The Exhibition will be held at King's College, London, for four weeks during the coming summer.

It will probably come as a considerable surprise to the public to know how much has been accomplished here since the war in industries in which previously we had been falling behind; and it is believed that the Exhibition will have a most stimulating influence upon scientific and industrial research by bringing home to manufacturers, as well as to the public, the supreme importance of science in industry.

Particulars of the Exhibition will be issued shortly. The organising secretary is Mr. F. S. Spiers, 82, Victoria Street, S.W.

Brighton Electricity Works Award.—The following is a copy of the award of the Committee on Production in respect of the employés of the Brighton Corporation electricity department:—

1. The parties to this reference are (1) the Brighton Corporation and (2) the Electrical Power Engineers' Association.
2. The claim is submitted on behalf of the technical staff of the electricity undertaking controlled by the Corporation for (1) the award of the Committee on Production of 15s. per week dating from August 1st, 1917; (2) the further award of the Committee on Production of 5s. per week dating from the first full pay day after December 1st, 1917.
3. The matter was referred by the Ministry of Labour to the Committee on Production for settlement. Representatives of the parties were heard on April 12th, 1918.
4. The award of the Committee is that the men concerned aged 18 years and over shall receive as from the beginning of the first full pay following April 12th, 1918, 20s. per week over their pre-war wages, all previous war wages or war bonuses (exclusive of service increments, advances for individual merit, and the bonus of 12½ per cent.) which have been granted since the outbreak of war being merged in the said 20s. per week.
5. The amounts hereby awarded are to be taken into account in the calculation of payment for overtime, or for work on Sundays or holidays, and are to be regarded as war wage advances and recognised as due to and dependent on the existence of the abnormal conditions now prevailing in consequence of the war.

George S. Gibb.
Geo. J. Rowe.
J. Duncan Elliot.

H. J. Wilson, Secretary,
5, Old Palace Yard, S.W. 1, *April 22nd*, 1918.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual general meeting will be held at the hall of the Institution of Civil Engineers, on May 30th, at 6 p.m., to receive and consider the accounts for 1917, and the annual report of the Council, and to elect auditors. The accounts and report will be printed in the number of the *Journal* to be published about May 21st (No. 274).

Further nominations have been received for the election of Council, namely:—Vice-President, Mr. S. L. Pearce. Ordinary member, Mr. E. B. Wedmore. The ballot papers have been issued, and are to be returned by May 8th.

Institution of Engineers and Shipbuilders in Scotland.—In the course of a paper on "Electrical Ship Propulsion," Mr. W. B. Hird pointed out that all who had worked at the question of electrical propulsion for any but quite small boats had turned to alternating-current apparatus, and usually to three-phase current, for effecting their purpose. The late Mr. Henry Mavor first proposed the changing of the periodicity of supply, which for marine propulsion had many advantages, and he hoped that the system associated with the name of Mr. Mavor and the Clyde would yet be given an opportunity of demonstrating its capabilities on a large scale.

Chief Technical Assistants' Association.—At a meeting held at Anderton's Hotel, E.C., yesterday evening, time permitting, the discussion on "Motor Converter *v.* Motor Generator" was to be resumed.

Liverpool Engineering Society.—On April 24th, Mr. R. Croston read a short paper on "The Micro-Photography of Metals"—evidently a slip for "Photomicrography," as the author uses the correct expression in the body of the paper—in which he gave brief particulars of the methods employed. In these days, when an engineer has to be conversant with so many chemical and physical tests and processes, such papers are of great utility.

Societe Internationale des Electriciens.—The annual general meeting was held on April 4th. M. Lucien Poincaré had been nominated in 1914 for the presidency, but having in the meantime accepted a position which would have clashed with this, he preferred to stand aside, and was unanimously elected honorary president. M. A. Larnaude was elected president for 1918-19, and M. X. Devaux-Charbonnel, Engineer-in-Chief of Telegraphs, president for 1919-20.

The Training of Disabled Fighting Men.—At a special meeting, last week, the Bradford Branch of the Electrical Trades Union received representatives of the local War Pensions Committee, the Technical College, the Discharged Soldiers' and Sailors' Federation, and the local electrical contractors, to confer on proposals for the training of disabled men for certain branches of the electrical trades. The meeting was under the chairmanship of the Deputy Lord Mayor (Alderman Squire Deighton). Rules for the guidance of a Joint Committee to carry out a scheme were considered, and, when finally approved by all parties concerned, will be submitted to the Ministry of Pensions. The scheme provides for the training and employment of about forty disabled ex-soldiers and ex-sailors. During 12 months' training, it is proposed that they shall spend half time each week at the Technical College and half time at a workshop.

Under the new Royal Warrant which came into operation on Wednesday last, men who undergo training, and who already may receive a bonus of 5s. a week covering the period of training, may, in addition, receive a further grant, not exceeding £10, for the purchase of tools, if those are required to be provided by the man in the trade in which he has been trained.

The Minister of Pensions has been informed that in certain instances sailors and soldiers who have been discharged for medical unfitness are unwilling to undertake regular work or to earn the highest wages they are capable of earning, because they fear that if they do so their pensions will be reduced.

It cannot be too widely known, he states, that disablement or minimum pensions are based solely on the degree of physical disability, and are not in any circumstances affected by the actual earnings of the men. So precise have been the intentions of the Ministry of Pensions in this matter, that instructions have been issued to the Medical Boards definitely forbidding the questioning of men regarding their earnings. The pension class of each man is established upon the degree of physical incapacity ascertained by medical examination. When it has been decided that no further improvement in the man's health may be expected his temporary pension becomes permanent and inviolate. It cannot be reduced, but if the condition of ill-health becomes worse it may be increased. Many permanent pensions have already been increased on that ground. Unwillingness to use one's working capacity to the full brings no advantage to the individual. On the contrary, an ample use of that capacity is not only a source of benefit to the man himself but must be regarded as a contribution to national efficiency.

By a slip, the name of the author of the article on page 429—Mr. C. W. Marshall, of Glasgow Corporation electricity department—was omitted.

Appointments Vacant.—Temporary clerk for the Rhondda U.D.C. electricity department; shift engineer for the Wellingborough Electric Supply Co., Ltd.; engineer-in-charge (£175) for the Worcester Corporation electricity works; fitter for the Borough of Burton-on-Trent electricity department; shift engineer (60s. + 8s. + 12½ per cent.) for the Borough of Swindon electricity department; two switchboard attendants (32s. + 20s. + 12½ per cent.) for the Burnley Corporation electricity works; shift engineer (60s. + 12½ per cent.) for the Radcliffe U.D.C. electricity department; engineer-in-charge (60s.) for oil-driven power station in the Northern Command; instructor in electrical work for the Sheffield Naval and Military War Pensions Committee; boiler house foreman (£200) for the Sunderland Corporation electricity works; shift engineer (60s. + 12½ per cent.) for the Eccles Corporation electricity department; improver as shift engineer for the Tonbridge U.D.C. electricity works; charge engineer for the Dover Corporation electricity department; meter inspector, installation inspector and tester, draughtsman (junior), fireman, switchboard attendants, and sub-station attendants, for the Greenock Corporation electricity department. See "Official Notices" to-day.

The Peace-time Activities of Vickers, Ltd.—A very interesting speech was delivered by Mr. Douglas Vickers at the annual meeting of the company, held at Sheffield last week, in which he told of certain important measures which the company is preparing for turning over from war-time to peace-time industries. We shall refer to the matter more fully in a later issue, but, according to a report in a Sheffield paper, we understand that the company had long intended to increase its electrical department in Sheffield, and had proposed to build new works on a large scale, probably outside Sheffield. Instead thereof, the directors have recently accepted an offer to be associated with the Metropolitan Carriage, Wagon and Finance Co. in the control of the British Westinghouse Co. This is thought to present much better prospects than building new works which would take a long time to get into working order. Electrical manufacturing will continue on much the same lines as before at Sheffield, but with a greater amount of specialisation.

The Apprehensive Rathenau.—During the war we have printed extracts from several interesting speeches delivered by Dr. Walter Rathenau. Whether he is still talking about preparations for the next war we do not positively know, but we think not. What he is now concerned about, according to the *Westminster Gazette*, is what is going to happen inside Germany after *this* war comes to an end. He is telling his countrymen very plainly that they must not expect the present period of brisk trade to continue. "Never was labour so fully employed as at present, he points out, never were wages so high or profits so big. But public opinion does not realise that all this prosperity emanates from one source—the State—which has to find the money for high wages and high profits by imposing heavy taxation. Dr. Rathenau foresees great difficulties in dealing with the mass of labour that will be thrown on the market after the war. Even if demobilisation is delayed, there will still be a vast surplus of labour, while production will be checked. Hence Germany will be faced with unemployment on a large scale, while at the same time the cost of living will not decrease. 'Gigantic tasks and enormous difficulties'—such is the gloomy language which Dr. Rathenau is driven to use in looking forward to the transition period after the war."

Fish Feeding by Electric Light.—The use of an electric light to catch fish is no new idea, but to feed them ——! A Kansas State hatchery has installed electric lights above the fish ponds, with the result that large numbers of insects are attracted to the vicinity at night. Eventually many of these fall into the water and are fed upon by the fish. The cost of food for the finny creatures has been about $1,000 a year, but under the present arrangement this expense will be reduced.—*Journal of Electricity.*

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending May 12th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Captain W. Hynam.

Monday, May 6th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, May 7th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 8th.—No. 1 Company, Drill, Knotting and Lashing, 6.30—8.30. Recruits' Drill, 6..0.

Thursday, May 9th.—No. 2 Company, Drill, Knotting and Lashing 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, May 10th.—Musketry, 5.30—8.

Saturday, May 11th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Sunday, May 12th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Marching Order, with rifles. Mid-day and tea rations to be carried.

Special Notice.—All drills will take place at headquarters unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The Whitley Report.—It is stated that the Admiralty have practically accepted the Whitley Report, and that it will be put into force in the Royal Dockyards, giving the workmen voice in the conditions under which they work, and in fixing the remuneration for their labour.

The Provincial Electric Supply Committee.—The annual meeting of this Committee was held on Tuesday, April 30th, at the Holborn Restaurant. The chairman, Mr. H. B. Renwick, presided, and the following representatives were present :—

Sir Henry Mance (Oxford Co.), Sir J. S. Harmood-Banner, M.P. (Midland Co.), W. L. Madgen (British Electrical Federation), F. E. Gripper (Edmundson's), Emile Garcke, A. A. C. Swinton (Cambridge Co.), J. E. Spagnoletti (Banbury Co.), J. G. B. Stone (Electric S. Corporation), G. H. Jackson (Northampton Co.), J. Herbert Edwards (Stroud, &c.), Talfoud Ely and J. J. Jeffery (Ross Co.), C. Shirreff Hilton (Birkdale Co.), H. B. Harvey (Kent Co.), K. A. Scott-Moncrieff (Hendon Co.), W. B. Esson (West London and Provincial Co.), G. W. Spencer Hawes (Reading Co.), H. B. Leather (Minehead Co.), John Christy and Leonard Christy (Clevedon Co.), Napier Prentice (Suffolk Co.), F. W. Reynolds (Coatbridge Co.), H. A. Alger (Richmond Co.), F. C. McQuown (Bournemouth Co.), H. W. Bowden (Woking Co.), J. L. Shand (Newcastle Co.), T. Petersen (Uxbridge Co.). Mr. Renwick, in opening the meeting, said that letters of regret at absence had been received from various members unable to be present. He went on to explain that the Committee was started at the beginning of 1917, and from an original number of 61 the total at the present day numbered 106 companies as members of the Association ; in fact, practically the whole of the important provincial supply companies throughout the kingdom. The Association grew out of the co-operation of the provincial companies under the appeal made by Mr. Renwick to the Excess Profits Commissioners, which resulted in the provincial companies being placed on a very favourable footing. The chairman, in reviewing the work of the year, ran over the various matters which had chiefly occupied the Committee's attention, including the Amendments to the Courts (Emergency Powers) Bill, by which clauses protecting water, heat, light, traction, and power were inserted ; the evidence given by the chairman on behalf of the provincial companies before the Board of Trade Electric Power Supply Committee ; negotiation with the Inland Revenue Authorities with regard to increased depreciation, local rating, leaving certificates, wages and bonus orders, and other matters ; also the conference with the Board of Trade to obtain increases in the maximum prices scheduled in Provincial Orders and with the same Department and the Ministry of Munitions, whereby support had been given to the companies in their revision of unremunerative long-term contracts. The position of companies using fuel oil had also been protected through the Petrol Controller of the Ministry of Munitions. Electric vehicles had received consideration, and the Committee were co-operating with the Institution of Electrical Engineers in regard to electric cooking. The Committee had also taken an important part in connection with the revision of the Reserved Occupations List and in connection with the Ministry of National Service. At the present moment the question of coal supplies and economies was the chief matter being dealt with. Sir J. S. Harmood-Banner, M.P., said that the result of the year's work were quite sufficient to show that they had acted wisely in creating this Association and supporting Mr. Renwick in his inauguration of the Committee, and although there were anxious times ahead, the companies' interests, in Mr. Renwick's hands, would be well looked after, and everyone felt they were under very good guidance. Sir Henry C. Mance expressed his appreciation of the assistance rendered to him by the Committee during the past year, and he urged the need for close co-operation and co-ordination of interests. Mr. Emile Garcke referred to the great success Mr. Renwick had achieved in bringing together such a representative body and the excellent work done during the first year. Mr. Madgen said he must emphasise the extremely useful and quite exceptional work put in and the practical management of the Committee, and he also emphasised the need for constructive co-operation, in view of the possibility of after-the-war demands. Mr. Campbell Swinton and Mr. F. E. Gripper also spoke on the work done during the past year. Mr. Renwick, in reply, explained that the very successful results which they had obtained must be taken as due largely to the assiduous work put in by the Executive Committee, without whose assistance he would not have been able to place such an excellent report before the members.

E.P.E.A. Concert.—The Electrical Power Engineers' Association (Midland Section) is holding a smoking concert at the Imperial Hotel, Temple Street, Birmingham, on Friday, May 10th. The chair will be taken at 7.30 p.m. by Mr. R. A. Chattock, M.I.E.E., the city electrical engineer of Birmingham. A large attendance is expected, and all engineers interested in the movement will be cordially welcomed. We learn that the Association is making excellent progress, and there is a steady influx of new members.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Tramways Committee is asking the Manchester Corporation to enter into an agreement with Mr. J. M. M'Elroy, the general manager of the tramways, under which he will undertake to remain in that position for five years, from May this year, at a salary of £1,500 per annum.

General.—Mr. J. Snow Huddleston has resigned his position with Messrs. Siemens Bros. & Co., Ltd., and has been appointed general manager of the Union Cable Co., Ltd., of Dagenham Dock.

Ald. J. M. Grey has resigned the chairmanship of the Electricity Committee of Burnley Corporation, which he has held for many years. The new chairman is Coun. Holden.

The many friends of the late Mr. J. M. Ralph will be interested to hear that a memorial is being organised to perpetuate his work in connection with the British Thomson-Houston Co. Funds have come readily to hand, but, due to the exigencies of the times, a number of letters have failed to reach their objectives. Will any old friends who are interested and have not received a notification kindly communicate with Mr. R. G. Hosking, 3, Bilton Road, Rugby?

Mr. W. H. Wilson has been appointed secretary of the London Electric Supply Corporation, Ltd., in succession to Mr. H. C. Carter, who has retired owing to ill-health. Mr. Wilson has been connected with the company since the early part of 1906.

Roll of Honour.—Captain H. E. Turner, who has been killed in action, was mains superintendent to the Hull Corporation electricity department. Only recently he had been decorated by the King of the Belgians for valour on the field.

Private A. Matthews, Lincolnshire Regiment, reported to be a prisoner of war, was an apprentice with Mr. J. E. Dyson, electrical engineer, Huddersfield.

Private A. E. Nixon, Dorset Regiment, killed in action, was the manager of the Electrical General Supply Stores, Leeds.

Private A. Mell, Worcestershire Regiment, reported missing, was an apprentice with Messrs. Flather & Co., electrical engineers, Leeds.

Signaller W. Briggs, W.R. Regiment, killed in action, was an electrical engineer at Eshton Hall, near Skipton.

Private S. Mairs, Cheshire Regiment, who is a prisoner of war in Germany, was employed by Messrs. Baxendale & Co., Ltd., Manchester.

Private H. Stringer, S. Lancashire Regiment, wounded, was employed by the St. Helens Cable & Rubber Co., Ltd.

Sergeant E. Wright, Machine Gun Corps, who was accidentally killed on April 19th, was formerly employed by the Peel-Conner Telephone Works, Ltd., Salford.

Mr. J. H. Atkinson, head of the carbon lamp department, B.T.H. Co., Rugby, has received news that his son, Corporal J. N. Atkinson, Machine Gun Corps, is wounded, and missing since April 12th. He was an apprentice at the Rugby works.

Sergeant W. Partington, West Lancs. R.F.A., who has been killed in action, was employed by Messrs. Dick, Kerr and Co., Preston. Gunner H. Crozier, R.F.A., employed by the same firm, has also been killed in action.

We desire to tender our sincere sympathy to Mr. and Mrs. E. Raymond-Barker, of Bisley, Gloucestershire, on the death of their son, Major R. Raymond-Barker, M.C., R.A.F., who was killed on April 20th in air action, aged 23.

Captain Michael Chapman, M.C., Grenadier Guards, who was killed on April 12th, was educated at Eton and Oxford, and, according to the *Times*, having qualified as an electrical engineer, he went out to Canada, and in 1906 he was for a short time on the staff of the late Lord Grey, before he eventually established an engineering business in Toronto. He was a son of Sir Arthur Chapman.

Second-Lieutenant C. N. Madeley, R.A.F., who died during an air fight on January 19th, was with the Westinghouse Co. at Manchester.

Sapper J. H. Wainwright, who was a master at the North-Eastern School of Wireless Telegraphy, Leeds, is a prisoner of war in Germany.

At the presentation of medals and honours for bravery to munition workers and others at Leeds, last week, by the Earl of Harewood, Lord-Lieutenant of the West Riding, Mrs. Lily, of Leeds, received the medal of the Order of the British Empire. Employed as a driver of an electrical overhead crane at an ordnance factory, she saved a workman who be-

came pinned between a pillar and a wheel of the moving crane by her gallantry in holding control to the stopping lever whilst the man was released, despite the fact that the sudden stoppage had caused a wheel to jump the line, and the whole crane, with her in it, was in momentary danger of collapsing. At the same investiture two Bradford telephone girls and a man telephone operator from the same city received medals under the Order, for gallantry in sticking to their posts, and thereby bringing up fire brigades, ambulances, doctors, nurses, &c., to a munition works which adjoined their exchange, and at which explosions were occurring at short intervals.

Lieutenant Harold Fisher, London Scottish, who was on the electrical staff at Hafod Colliery, has died of wounds.

Sapper Bird, R.E., who was prior to the war on the staff of Mr. Hall, borough electrical engineer at Burton-on-Trent, reported missing on March 21st, is a prisoner of war.

Private W. Johnson, K.O. Yorkshire Regiment, killed in action, was an electrical engineer, employed at various times by Messrs. Johnson & Phillips, Ltd., and Messrs. Bruce Pebbles & Co., and at Portsmouth Dockyard.

The death in action is reported of Second-Lieutenant Thomas Silver, a member of the Tramways Committee of the Birmingham City Council.

Rifleman W. J. Bridge, eldest son of Mr. Albert Bridge, commercial editor of the Electrical Review, is officially reported "missing" since March 23rd. Correspondence shows that he was wounded and, with many others, had to be left behind.

Rifleman R. Scarlett, 8th, K.R.R., who was condenser attendant at the Grove Road power station of the Central Electric Supply Co., is a prisoner of war in Germany.

Second-Lieutenant G. Gibbens, Middlesex Regiment, head storekeeper at Grove Road power station of the Central Electric Supply Co., was killed in action in France on April 2nd.

Corporal W. H. Barker, London Regiment, formerly in the general office of the India-Rubber Co., Silvertown, has been wounded in France.

Lance-Corporal W. Bain, M.G.C., who was in the proofing department of the India-Rubber Co., is now a prisoner in Germany. He joined up in 1914 and went to France, but on discovering that he was only 16 years of age the authorities sent him home. On attaining the age of 18 he rejoined, and went out again.

Obituary.—The *Times* of yesterday says that a Berlin telegram to the *Kölnische Volkszeitung* reports the death of Herr Arnold von Siemens, member of the Prussian Upper House, and chairman of the board of directors of Siemens and Halske.

Mr. J. W. Rook.—We regret to learn, as we go to press, of the sudden death of Mr. Rook, the managing director of the Sloan Electrical Co., Ltd.

CITY NOTES.

British Electric Transformer Co., Ltd.

The annual meeting was held on Tuesday at Salisbury House, E.C. Mr. A. F. Berry, who presided, said that the gross profit on the trading showed an increase of about £4,600, while the net profit was nearly £1,400 more than last year. The directors recommended that a further £7,500 be placed to reserve, bringing that fund up to about £52,000, which had been built up almost entirely out of profits. The depreciation reserve, with the £1,500 to be added, would stand at £15,300, which represented about 25 per cent. of the value of the two assets in the balance sheet against which it was built up. The ordinary shareholders were to be congratulated on the resumption of payment of the 10 per cent. dividend which they enjoyed for three years prior to the outbreak of war. During the past three years they had retained in the business some £7,000 by reducing the rate of dividend to 7½ per cent. That retained money had been most useful in the business, and had helped to carry out the volume of orders, one result being that they were now able to pay 10 per cent. dividend again. He did not say that they considered 10 per cent. a full and sufficient "peace-time" distribution on ordinary shares, and, although no one could say what the immediate future held for them, he personally hoped the time would come when they would do much better. He might mention that they started the current year with about 90 per cent. more work in hand in money value than they did the year 1917, although some of it was work they would not deal with for a long time. The question of finding new money to carry out the increased amount of work they had received became very pressing during the latter part of the year. In view of all the circumstances, they felt it desirable to issue the remainder of their shares, and he was pleased to be able to inform them that, having obtained the Treasury sanction to the issue, they had now been able to place all the remaining unissued shares of the company. Certain friends of theirs in the City thoroughly examined the works, and discussed the prospects of the company with himself and his colleagues some time ago, and before the excellent figures now before them were available. They were so impressed with the soundness of the company and the possibilities of expansion after the war that they made them a bid for the shares, and the directors felt it advisable, in view of present conditions, to accept the bid without waiting to offer the shares to the shareholders. At the same time they wished to retain for their old shareholders an opportunity of participating in the further issue of capital. They had therefore arranged with their friends that they should give existing shareholders an opportunity of taking up a portion of the shares in question, and he was pleased to be able to say that the buyers readily consented to do this. Each shareholder could, therefore, obtain further shares within the limits of the issue in the following ratio, three preference shares at 17s. each to one ordinary share at 18s. 6d. per share, and this offer would remain open until May 6th. Having spoken in terms of warm appreciation of the splendid effort that had been made by the employés of the company in helping to "carry on" ever since the outbreak of war, and referred with pride to those serving their country at the Front, he said that the work that had been accomplished in the past in their two special lines had for a long time past been increasingly great, but for 1917 it was easily a record. While transformers had been delivered by the hundreds of thousands of horse-power, they had also found their "Tricity" department of the greatest possible value. There was for the electrical engineering industry a large place in the world's future work. Although no industry was more hampered, perhaps, in its early days by legislation, by the "dumping" of foreign goods and of those made by sweated labour, than theirs, those matters were most certainly going to be corrected, and soon. Many of them in the engineering world were making time to attend reconstruction and other committee meetings with a view to encouraging greater co-ordination of designing, manufacturing, and other efforts, so as the better to bear their part in the future. Shareholders in such a company as theirs might well look forward with interest and satisfaction, for never before had they been so united in industry, nor, speaking broadly, so efficient. A point of greater importance, and one upon which their manager had always insisted, was that by continuing and extending in their own lines of business during the war they were contributing their greatest weight to the efforts towards victory. They had made neither actual munitions nor excess profits, but they had, by contributing many hundreds of thousands of invaluable plant and apparatus to war industry, done far better. They anticipated that after the war they should be ready immediately and fully to bear a hand for efficient reconstruction and development. In conclusion, he remarked that he had dwelt on these matters of co-operation because there was, in his opinion, imperative need of them, and he believed that their individuality and enterprise could best be maintained, even stimulated, by giving rein to the spirit of unity in preparing for peace.

Urban Electric Supply Co., Ltd.

The gross profits for 1917 were £67,732, as against £64,983 for 1916. £64,521 is carried to net profit and loss account. Interest, debenture stock redemption, and income-tax absorb £45,547, leaving, with £1,774 brought forward, £20,748. Out of this there is put to reserve for depreciation £10,000, 2½ per cent. is to be paid on the preference shares, requiring £6,250, and £4,498 is to be carried forward. In order to give additional power supply necessary to various establishments in the Twickenham Co.'s area, the Government is arranging to advance to the Urban Co. for plant and mains additions £75,000 at 6 per cent. interest on the security of a floating charge ranking behind the existing debenture stock, the repayment being spread over a term of 15 years. At the meeting shareholders will be asked to sanction an increase in the borrowing powers. The company is to be safeguarded against the risk of having to bear the cost of superfluous plant left on its hands owing to the load dropping off after the war, and with the provision of this safeguard the directors believe that the expenditure of this money advanced by the Government will prove beneficial to the company. The directors have arranged to renew the agreement with Edmundsons, which expired on March 31st last, for a further period of five years on practically the same conditions as before, except that the annual sum payable for management and administration is increased to £3,000. This sum is very considerably below any figure at which the company could be administered independently of Edmundsons, and the directors are satisfied that the increase is justified by the large expansion of the company's business and by the heavy additional expenses of administration. A comparative statement of profits derived from the undertakings and particulars of the load connected in kw. appears below:—

	Kilowatts.		Profits.	
	1916.	1917.	1916.	1917.
Hawick	3,181	3,369	£5,653	£5,863
Stamford	1,679	1,720	1,625	2,208
Weybridge and Walton	3,977	3,654	4,385	5,488
Godalming	1,498	1,800	2,040	2,247
Twickenham and District	8,413	9,191	16,109	15,175
Dartmouth	978	1,088	1,108	1,116
Camborne and Redruth ("A") and Cornwall ("B")	7,345	8,032	"A" 7,523 "B" 7,598	"A" 8,080 "B" 7,234
Newton Abbot	1,202	1,337	2,242	2,728
Grantham	1,892	1,983	7,640	8,708
Glossop	1,317	1,423	3,118	3,970
Berwick	1,088	1,188	847	1,066
Caterham	862	991	1,277	1,168
Newbury	1,164	1,323	3,076	3,366
Totals	33,886	36,902	£64,966	£67,717

London United Tramways, Ltd.

The gross receipts for 1917 were £354,473, an increase of £18,138, but the expenses increased by £23,595. After deducting the adverse balance of £2,583 brought forward, and all expenses, the balance is £60,028, which is required for the carrying out of repairs and renewals as and when it becomes practicable to carry out such work. The charges for interest on the first mortgage debenture stock and loans amount to £71,627. Since the appointment of a receiver last June, negotiations have been carried on by the directors and a committee appointed by the 4 per cent. first mortgage debenture stockholders with a view to the reconstruction of the capital and the rehabilitation of the tramways undertaking. These negotiations have resulted in a provisional arrangement under the terms of which, subject to the Bill referred to below passing into law, both the loan and share capital will be substantially reduced, and funds will be provided for the reconstruction and renewal of the tramways. The Bill which is being promoted with the concurrence of the Debenture Stockholders' Committee, has among its objects an extension of the company's tenure of the tramways, and power to increase fares beyond the limits fixed by the company's previous Acts.

Metropolitan Electric Tramways, Ltd.

The revenue for 1917 was £594,085. After including the balance brought forward, deducting expenses, and providing £22,687 for future reconstruction and renewals, the available balance is £22,910. There is put to reserve £9,874, 2 per cent. is to be paid on the preference shares requiring £10,000, and £3,036 is to be carried forward. The traffic receipts were £38,193 better than in 1916. The revised scale of fares over the whole system to meet increased cost of working only became fully operative in October. The increase of fares has undoubtedly had the effect of bringing in additional gross revenue, but "the fares will have to be raised to a higher scale if the company is to be in a position to meet the continued increase in the working expenses due to the higher cost both of materials and labour." The units sold by the North Metropolitan Electric Power Supply Co., Ltd., increased by 18 per cent. over 1916, the increase being mainly due to the larger supply given to power-users engaged in the manufacture of munitions or other war contracts. The gross profits of the Power Co. for 1917 increased by £4,759.

British Westinghouse Electric and Manufacturing Co., Ltd.

The available profit for 1917, including £89,735 brought forward, is £177,859. Out of this £48,000 has been put to special depreciation of plant, machinery, &c., £10,000 to additional reserve for employers' liability, the preference dividend of 7½ per cent., less income-tax, requires £68,625, and £51,234 is to be carried forward. Mr. P. A. Lang has resigned his seat on the board, but his great experience will remain entirely at the disposal of the board in the capacity of technical adviser. Mr. Lincoln Chandler (one of the managing directors of the Metropolitan Carriage, Wagon and Finance Co., Ltd.) has been appointed managing director to fill the vacancy. Mr. W. W. Blunt, who has also resigned his seat on the board, will for the future give the whole of his time and attention to the supervision of the commercial department of the company. Sir E. V. Hiley, K.B.E. (a director of the Metropolitan Carriage, &c., Co.), and Sir F. H. Barker (a director of Vickers, Ltd.) have been elected to the board. The directors are now:—J. Annan Bryce, M.P. (chairman), Sir E. V. Hiley (vice-chairman), Sir F. H. Barker, Lieut.-Col. Montague Cradock, Norman B. Dickson, M.I.C.E., Sir E. A. Goulding, Bart., M.P., Alex. Spencer, and Lincoln Chandler (managing director). Annual meeting: May 6th.

Johnson and Phillips, Ltd.

At the annual meeting held last week, Mr. W. Claude Johnson, who presided, referred with regret to the death of the late chairman, Mr. R. W. Blackwell, who had controlled the destinies of the enterprise since its inception as a public company with a success that was patent to all. The figures in the annual report showed a considerable improvement over those of 1916. The trading profit for the year showed an increase of about £14,000. The reserve account now stood at £40,000, and the special reserve account £10,000, while the reserve *re* debenture sinking fund and the debenture redemption suspense account amounted together to £78,251, making a total reserve of £128,251. The total assets now exceeded current liabilities, including all debentures, by well over £320,000. These figures demonstrated that the business was in a thoroughly sound position. A further sum of £11,000 odd had been expended during the year on additional buildings and plant. The output for the year under review was a record by a very large amount, and they would be interested to hear that the turnover for the current year far exceeded that of the corresponding period of last year, and the works were as full up as they could well be with orders, which fully justified the large outlay on new plant made by the company during the last few years. They had, of course, had a great many difficulties to meet in carrying out the vast amount of work entrusted to them, but they had met the position as successfully as possible under existing circumstances. Material had become more and more difficult to obtain, and the question of labour had caused constant anxiety. The men had worked both loyally and patriotically. As to the future, it was impossible to foretell what might happen during the next 12 months, but as far as the board could see there seemed little doubt that the output would be maintained, and there was no reason to think they would not get their fair share of any business that might be going.

Mr. Thomas Deuce said that the present position of the company as compared with what it was five years ago was a very pleasing contrast, and the improvement had been brought about largely by the work and devotion of Mr. Blackwell, assisted by the other directors.

Replying to a shareholder, the Chairman said there was no part of the works idle. Their factory at Charlton was fortunately fitted up with machinery that complied so well with present requirements that there was hardly such a thing as an obsolete machine in the place. He believed their work in connection with submarine matters would revive with great energy after the war. The works were designed not only for making and designing machinery for laying and picking up submarine cables, but for making them, and prior to the war they made machines not only for English firms, but also for those abroad.

Coalite, Ltd.—The report for 1917 states that by the appropriation of the surplus of reserve account the item of general expenditure in the balance sheet was reduced by £12,495. The directors have arranged with various creditors for a substantial reduction of their claims. This, with the assistance of various other credits, makes the balance added to this item only £191 for the year. An agreement has been entered into with Low Temperature Carbonisation, Ltd., to manage that business for 10 years. Effective progress in dealing with the company's interests in foreign countries and the Colonies can, however, hardly be looked for until after the termination of the war. The company's patents in foreign countries and the British Dominions have been maintained and added to during the past year.—*Financial Times.*

Bath Electric Tramways, Ltd.—Mr. J. B. Hamilton, presiding at the annual meeting, said that the traffic revenue had increased by £4,784. The character of the traffic had changed, due to the war. The working costs had risen considerably. The outlook for the current year was less cheerful. They were to reduce their coal consumption, which meant a reduction in power which might vitally affect earning capacity, but they would try to meet the situation by altering their stoking plant, and, perhaps, the class of fuel used, and thus attain the desired result without causing more than a small reduction in mileage. The tramway undertakings desired to increase fares to compensate them for increased cost, and a Bill was to be introduced by the Board of Trade after a committee had inquired into the merits of their applications.

South Metropolitan Electric Tramways & Lighting Co., Ltd.—The revenue from all sources in 1917 was £86,139, compared with £68,793 for 1916. After adding the balance brought forward, deducting expenses, and setting aside £6,000 to the renewals fund, the surplus is £20,152. There is put to reserve £4,000, dividend of 6 per cent. on the preference shares for 1916 absorbs £10,174, and payment on account of preference dividend for 1917 at the rate of 3 per cent. £5,087, leaving to be carried forward £891.

Browett, Lindley & Co., Ltd.—After paying a full year's dividend at 6 per cent. per annum on the preference shares, and a further 4½ per cent. thereon on account of arrears, less tax, the ordinary shareholders receive 6 per cent. per annum, less tax, for 1917.

Altrincham Electric Supply, Ltd.—Mr. C. J. Ford, presiding at the annual meeting, said that the operations of the year, though difficult, had been more favourable. Sale of current for power would provide the main portion of the profits in future. The district would show further industrial expansion during the next few years.

Argentine Tramways & Power Co.—During the year ended September, 1917, the tramway receipts showed a decrease, partly due to a strike, but economies were effected. There was an increase in light and power receipts, and in net revenue. Owing to the war progress has not been sufficient to permit of payment of the preference dividend. No large improvement is expected while the war lasts.

North Metropolitan Electric Power Supply Co.—Dividend at the rate of 6 per cent. per annum, and a bonus of 8s. per share, on the ordinary shares for 1917.

West India & Panama Telegraph Co., Ltd.—Final dividend for 1917, 6d. per share, and a bonus of 3d. per share on the ordinary shares, free of tax.

Monte Video Telephone Co., Ltd.—Interim dividend for the half-year ended January 31st at the rate of 6 per cent. per annum, free of tax, on the ordinary shares.

City of Buenos Aires Tramways Co. (1904), Ltd.—Quarterly dividend of 1s. 3d. per share (5 per cent. per annum), less tax.

River Plate Electricity Co., Ltd.—Dividend on the ordinary shares 7 per cent. for 1917.

F. Reddaway & Co., Ltd.—Profit for 1917 £646,644, against £42,534. Dividend on ordinary shares 8 per cent., carrying forward £24,529. Unless the restrictions imposed by the War Trade Department on the export of canvas hose and beltings are modified the board will have to consider the closing down of the textile section of the works.

Clarke, Chapman & Co., Ltd.—The £10 ordinary shares are to be divided into 10 shares of £1 each, and the preference dividend is to be increased from 6 per cent. to 7 per cent.

Auckland Electric Tramways Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum, less tax, is to be paid on the ordinary shares.

Stewarts & Lloyds, Ltd.—Resolutions have been passed increasing the capital to £3,100,000 by the creation of 850,000 deferred shares of £1 each, of which one-half are to be issued.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—The Treasury has sanctioned the issue of £17,500 6 per cent. prior lien debentures (£100 each), which are being offered to the share and debenture holders.

Direct United States Cable Co., Ltd.—The reserve fund at March 31st showed a balance of £528,626, an increase of £26,115 for the year. A final dividend of 2s. per share, less tax, makes a total of 4 per cent. for the year.

Adelaide Electric Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 10 per cent. per annum, free of British income-tax.

Melbourne Electric Supply Co., Ltd.—Interim dividend on the consolidated ordinary stock at the rate of 10 per cent. per annum, free of British income-tax

Evered & Co., Ltd.—Though the accounts for 1917 cannot be issued, the figures are sufficiently satisfactory to allow of the payment of a dividend of 8 per cent. per annum, less tax.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets continue to hang upon the news from the Western Front. There is not much change in prices, because there is not much business doing. The effect of the Budget can be said to have worn off. One rather surprising result is a stiffening of prices amongst the best class of securities, holders of which were relieved to find that the income-tax was not put up more than 1s. in the £, while people with money to spare have begun once more to look at gilt-edged investments. Strength in the war stocks makes a contribution to this movement. Once again it deserves mention that there are comparatively few good debenture stocks or preference shares obtainable, whereas a month ago the supply became augmented on behalf of those who anticipated a much more severe income-tax than the Chancellor has imposed.

Underground Electric Railway income bonds have given way to 74, because of the apprehension felt in some quarters that the rise in the income-tax may result in a diminution of the 4 per cent. interest which the company is now paying on these bonds. Except for this, the railway market on the whole is rather better, and Metropolitans have recovered ½. Steam stocks are also on the firm side.

The demand for cable and cable manufacturing shares, the dividends on which are paid tax-free, remains insistent. No particular changes have occurred in prices. Great Northerns are better at 36½. The Eastern group continues very strong, and all the improvements secured last week have been maintained. Oriental Telephones have risen to 4 3/16, and United River Plate are better at 7. Anglo-American preferred at 98 is ex dividend, and the ordinary stock is also quoted ex at 56. In the manufacturing group, Henleys, Callenders, and British Insulated are decidedly good, and the electrical manufacturing list is fairly steady. British Aluminium have further receded, in consequence of opposition that has developed to the company's water scheme in the Highlands. Lively controversy goes on in regard to what the objectors to the scheme lament as a blow to the natural charm of the locality, while, on the other hand, the economic advantages of the proposals are held to outweigh any disturbance to the beauties of nature that may be caused.

British Westinghouse preference have fallen to 2½, on the issue of a report which can only be regarded as disappointing. The net profit has fallen from £199,000 to £88,000; the preference shares again get 7½ per cent., but this time it is not free of tax. Last year the company wrote off £25,000 from patents and goodwill, but nothing is set down in the present accounts against this item. The carry-over of £51,000 is £38,000 less than that brought in from last year. This is a very unpleasant jar to those who were talking about the possibility of the company being able to raise its dividend almost at once. It was less on dividend hopes than on the expectation of a combination of interests that the price of the shares was recently run up to 3 3/16, though the combination idea seems to have evaporated into thin air, at all events for the present. But well-informed folk think that this is certainly not the time to sell Westinghouse preference.

London shares continue dull in the list of home electricity issues. Citys are ½ down at 12, and Countys eased off to 10⅜. There seem to be shares about which take some time to absorb. Charing Cross keep heavy at 3¼. The North Metropolitan Supply Co. repeats its former dividend of 10 per cent., and the £81,000 available for distribution is about £600 better than a year ago.

Amongst foreign descriptions, Brazil Tractions have been better at 42½, reverting, however, to 42, and thus showing no change on the week. Anglo-Argentine 5 per cent. debenture stock lost a point, and British Columbia Electric 4½ per cent. debenture stock at 57 is similarly down. There is no improvement in Mexican varieties. The market remains frankly dull, and the tendency is still to sell where opportunity occurs for doing so. Some of the Brazilian bonds are rather better, and Sao Paulo first mortgage debentures have hardened to 87, which is about the same price as the 5 per cent. first mortgage gold bonds of the Rio Tramways. Victoria Falls preference have advanced to 22s., with a fair amount of business doing in them, and the ordinary shares are a little better at 17s. 6d. Industrials keep pretty steady on the whole. Armament, iron, coal, and steel shares are hard on the fact of the excess profits duty not having been raised. A further sensational rise in the price of tin has caused but little fresh activity in tin mining shares. Rubbers are quiescent, a rise to 2s. 6d. in the price of the material being followed by reaction of a few halfpence.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price April 30, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	8⅞	—	£7 8 0
Charing Cross Ordinary ..	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	2⅝	—	6 18 6
Chelsea	3	5	3	—	8 6 8
City of London	8	8	12	— ½	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	16⅜	— ½	6 18 4
do. 6 per cent. Pref.	6	6	9¾	—	6 0 4
Kensington Ordinary	6	7	8⅝	—	6 10 3
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	8⅛	—	6 0 0
Metropolitan	3	4	3⅝	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2⅛	—	7 2 4
South Metropolitan Pref. ..	7	7	21⅛	—	6 18 4
Westminster Ordinary	7	9	6½	—	7 3 10

TELEGRAPHS AND TELEPHONES.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	98xd	—	6 7 8
do. Def.	8⅛	1¼	12⅜	—	6 14 10
Chile Telephone	8	8	7⅞	—	5 8 4
Cuba Sub. Ord.	6	7	9⅞	—	*7 8 7
Eastern Extension	8	8	16⅜	—	*5 4 1
Eastern Tel. Ord.	8	8	154	—	*6 4 0
Globe Tel. and T. Ord. ..	7	7	14⅜	—	*4 17 5
do. Pref. ..	6	6	9⅞	—	6 3 1
Great Northern Tel.	22	24	86¼	—	6 11 6
Indo-European	13	13	61⅜	—	6 6 8
Marconi	15	15	8¾	—	4 17 10
Oriental Telephone Ord. ..	19	19	4 3/16	+ 1/16	9 10 0
United R. Plate Tel.	8	8	7	+ ⅛	*6 16 4
West India and Pan.	6d.	6d.	1⅛	—	*3 6 8
Western Telegraph	7	8	15¾	—	*5 4 1

HOME RAILS.

Central London, Ord. Assented	4	4	62½	+ 1	6 8 0
Metropolitan	1	1	20⅝	+ ⅜	4 16 9
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A" ..	Nil	Nil	4/8	—	Nil
do. do. Income	6	4	74	—1	*5 6 8

FOREIGN TRAMS, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	47	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅜	—	—
do. 2nd Pref. ..	5½	—	2⅜	—	—
do. 5 Deb. ..	5	5	63	—1	7 16 4
Brazil Tractions	4	4	42	+1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	51⅞	—1	9 14 2
do. do. Preferred	Nil	Nil	32⅛	—	Nil
do. do. Deferred	Nil	Nil	25⅛	—	Nil
do. do. Deb.	4½	4½	57	—1	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	36	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	17⅛	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	86½	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	8½	—	4 12 4
British Aluminium Ord. ..	7	10	1⅛	— 1/16	6 8 0
British Insulated Ord.	17½	20	8⅜	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2⅝	—	6 0 0
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8½	—	5 14 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1½	—	6 0 0
Gen. Elec. Pref.	5	5	10⅜	—	6 15 8
do. Ord.	18	18	30½	—	4 18 9
Henley	25	25	19xd	—	6 6 7
do. 4½ Pref.	4½	4½	9⅜	—	5 18 2
India-Rubber	10	10	12⅛	— ½	*3 8 0
Telegraph Con.	30	30	42	—	*5 13 0

*Dividends paid free of income-tax.

DISABLED SOLDIERS AS METER REPAIRERS IN GLASGOW CORPORATION ELECTRICITY DEPARTMENT.

During the early part of 1917 the chief engineer of the G.C.E.D. decided to give employment to a number of disabled soldiers. The decision was arrived at purely on humanitarian grounds, as every day brought in a considerable number of men seeking employment, who almost invariably reported that they had failed to get anything more than expressions of sympathy in their search for work. A number of the men were allocated to the meter-repair workshop, and it is the purpose of this article to describe in some detail the results of the experiment.

The men were taken practically at random from a batch of applicants, and in no case had they previous experience of any value. The diversity of trades may be gathered from the fact that the list included a miner, a railway shunter, a tramcar conductor, and a calico printer. The nature of their disablement was in all cases loss of one leg. The only hopeful point seemed to be the very respectable class of men and their undoubted anxiety to acquire sufficient knowledge and skill to render themselves self-supporting.

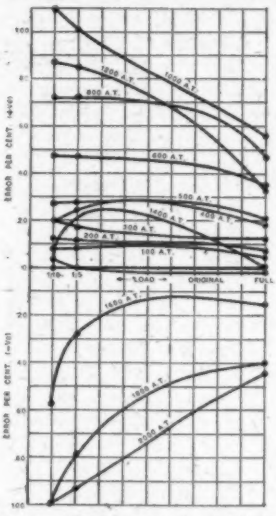


Fig. 1.—Ferranti 5 A. D.C. Meter.

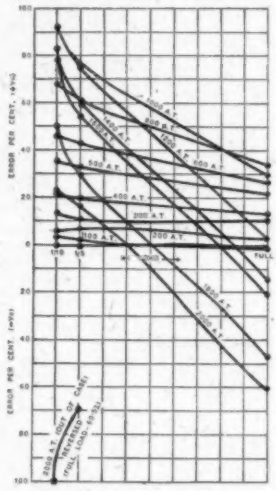


Fig. 2.—C. & H. 5 A. Meter.

Tests on Effect of Reducing Strength of Magnets.

The work to which attention was first given was the repairing and cleaning of Chamberlain & Hookham and Ferranti mercury-bath ampere-hour meters. A meter was taken apart, and the various pieces were mounted neatly on a wooden board to serve for demonstration purposes. The names of the parts were then gone over, and the general construction was explained by an experienced workman. A demonstration of dismantling and reassembling was then given, and the order in which the various operations should be carried out was carefully emphasised. It was decided that each man should carry out all the work on the meter himself, so as to make matters as interesting as possible. This method of working calls for greater all-round skill on the part of the meter repairer, but has the great advantage that the absence of any man does not affect the output of the others. For some time afterwards, all the men were kept on one type of meter, and an experienced worker helped whenever difficulties appeared. During the early stages it seemed likely that some of the men would fail to obtain the starting-current results desired; but in the course of a few weeks, this difficulty disappeared, and the results are now entirely satisfactory.

One feature of the experiment must be recorded at this point—namely, the very willing and generous way in which the meter repairers gave their assistance to the soldiers. Whenever any difficulties appeared these men gave the learners the benefit of their experience, and it is largely due to this fact that the experiment proved successful.

Later on, when new types of meters were brought in for repair, everyone was anxious to master the work in the minimum of time, and after a few days' practice, each soldier could readily overhaul any type of meter put before him.

The mechanical part of the training had nothing at all special in it, the only points emphasised being the necessity for absolute cleanliness and tidiness, and in this respect the new-comers soon surpassed the older workmen.

The working hours were at first 6.30—9, 9.45—1, 1.30—5.45, but later on these were reduced to 8—12.30, 1.30—5.45, with very satisfactory results. Smoking was allowed during two 20-minute periods each day, and this seemed to be appreciated.

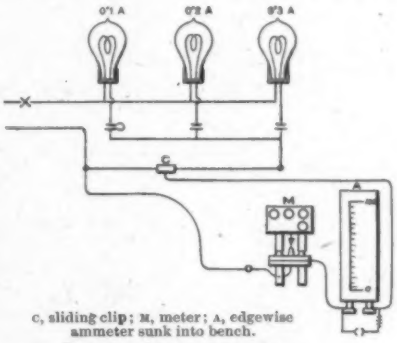
In order to create and maintain interest in the work, weekly lectures on electricity were instituted. These were held during working hours, and simple demonstrations of magnetic and electric phenomena helped to clear up many of the difficulties met with in the course of the work.

Whenever a meter failed to pass the laboratory tests it was returned to the repairer along with the test results, and when anything of special interest occurred, it was explained to all the men as well as to the person directly concerned. As an example of this, it was found that several men remarked on the fact that a large proportion of the meters which did not pass were correct on full load, but fast on light loads, while the starting currents showed the meters to be in good mechanical order. It was explained generally that this trouble was due to weak magnets, and, in order to emphasise the point, the magnets of two good meters were demagnetised by definite steps, and tested at each step. The results of these tests are shown in figs. 1 and 2. The effects of remagnetising were also explained and demonstrated.

The great interest shown in these tests and lectures, which from lack of time could not be properly prepared, encouraged the superintendent to ask for assistance from the meter manufacturers. This was promptly given, and each of the companies from which meters are bought sent a representative to give a lecture and demonstration of his particular speciality. This movement made a very great difference in the methods employed in handling meters, and many of the time-honoured practices of the G.C.E.D. meter workshops were relegated to the scrap heap.

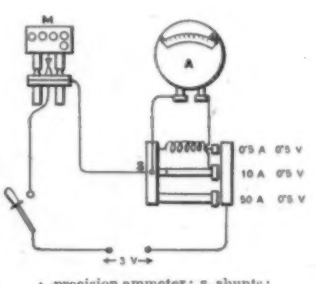
As time went on the men became more confident, and instituted improvements on their own initiative—for example, they connected up their lamps for starting-current tests in series, so as to get lower currents for test purposes. They also made rough tests on meters by calibrating several lamps to give different loads. To encourage this spirit each bench will now be provided with a variable-range ammeter and simple arrangements to give currents up to 0·5 ampere. A sketch of the fittings provided is shown in fig. 3. The reason for using this method was that it gave the results with minimum delay and cost, the lamp board being already in existence and the ammeters having been taken from a discarded switchboard. All data regarding the instruments are marked clearly on the scales.

The standard practice of the department is to use mercury



C, sliding clip; M, meter; A, edgewise ammeter sunk into bench.

Fig. 3.—Apparatus for Starting-Current Tests.



A, precision ammeter; S, shunts; M, meter under test.

Fig. 4.—Apparatus for Testing Meters before Casing.

ampere-hour meters for house service, and so these form the bulk of the work; but the men are shown the construction of other types of meters whenever opportunity occurs. They now know the general features of commutator and electrolytic meters, and have also been shown one or two types of alternating-current meters.

The laboratory tests and the calculations involved are also well understood by the meter repairers, and they are occasionally called on to assist in testing and adjusting meters.

A further operation is to be performed on meters in the course of repair, in order to diminish the probability of failure during the acceptance tests in the laboratory. This is to test each meter at two loads before it is put into its case. The points chosen are full load and 20 per cent. of full load; the testing arrangements are shown in fig. 4. In this case, too, existing apparatus was utilised, as far as possible, so as to minimise capital expenditure. The shunts were made in the workshop of the department, and were arranged to suit standard meter capacities. Meters of over 100-ampere capacity are tested at this stage without their shunts.

This test will be performed by the repairers themselves, the men each taking a week of testing in succession.

In order to provide an occasional break in the routine, men who have attained sufficient arithmetical proficiency, and who volunteer for the work, will be trained as observers for machine tests. It is hoped thereby to enable the department to make regular steam consumption tests on turbines at a reasonable cost, and the work will at the same time provide interesting recreation for a very deserving class of men.

The general conclusion drawn from experience is that the experiment is completely successful, from the standpoint of both sound workmanship and finance. Electricity supply undertakings can confidently be recommended to try disabled soldiers as meter repairers, and they can rest assured that a very few weeks of practice will enable any intelligent man to master the essentials of the work. It stands to reason, however, that payment must be on a fairly liberal scale even during the non-productive period, as otherwise the men will be discontented and Trade-Union troubles are sure to occur.

THE SAVING OF FUEL.

By C. M. BENNETT, Wood Lane Works.

Everybody connected with the management of works where coal is used for the purpose of power production understands the importance of making use of the coal in the most economical manner possible; nevertheless, the importance of strict boiler-house supervision and organisation has not been, and is not always, fully recognised. It is in the boiler house that the greatest saving can be made, and in times like the present, when economy in fuel is of national importance, the attention of engineers should be directed towards the organisation of the boiler house—the Cinderella of generating stations and industrial works generally.

If we look into the past, we shall find that the boiler house, or stokehold, as it was called, did not receive the same attention at the hands of the engineers and managers of undertakings as did the engine house. Perhaps this was natural when looked at from the point of view of personal comfort and cleanliness. The engineer is a person of some consequence, and although he may be temporarily disfigured by a spot of oil without loss of dignity, a smudge from coal on any portion of his person was not to be thought of.

For some reason or other, the most important place seemed to be that in which the generating machinery was housed. The mental efforts of the engineers were directed towards schemes and refinements to improve the economy of this section of the plant, to embellish it with the most wonderful flights of architectural genius, and to add to the comforts of the staff in the engine house. As long as the coal was burning in the furnaces, how well or badly it was burning so long as pressure was maintained did not matter much.

From the time of the first conception of a new power house, even in the preliminary sketches in the consulting engineers' office, the position and design of the boiler house seemed only a secondary consideration. The engine house must have a colour scheme in glazed bricks, but anything would do for the boiler house as long as the old colour scheme of black was thoroughly carried out, the want of ventilation was very marked, and natural light was more or less eliminated. The accommodation of the steam-raising plant in dark and underground places was the rule.

It is perfectly certain that if the same care and attention were given to the design of the building and to the comfort of the steam-raising staff as to the design of the engine house and the comfort of the staff operating therein, the effect on the economical production of power would be at once very marked.

The attention of young engineers and chemists would be directed towards this most important branch of power production, and men would be encouraged to specialise in boiler-house operation and fuel economy. The conditions and surroundings should be such as would attract them: a boiler house, in fact, should be just as much a show place for visitors as the engine room is. The utmost space should be reserved for natural light, and the best possible scheme for ventilation, and the removal of coal dust and fumes, should be adopted. The walls should be faced with white glazed bricks, and every effort should be made to obtain and preserve a bright, spick-and-span appearance.

There is a natural tendency to consider that the boiler-house staff comes second to that of the engine house; this is a great mistake. It is the opinion of the writer that the boiler-house staff comes first, for the boiler house is the heart of the whole undertaking, and more money can be saved in this section of a works than in any other. Perhaps the day will come when the charge engineer in the boiler house will be in a position to abuse the charge engineer in the engine house for wasting his coal by allowing the steam traps to dribble, and the lagging on the steam pipes to remain defective. Perhaps the charge engineer in the boiler house will have something to say about the engineers taking more steam in consequence of dirty condensers. Concentration and keen interest will only come about when the conditions obtaining in most boiler houses are altered, and this most important section of the works is put upon the plane of importance it should justly occupy. Then, and only then, will scientific boiler-house operation attract the attention of the right sort of men, and only then will the interest of young engineers be directed towards the boiler house in preference to the engine house. Boiler-house operation and management will become a department of itself in a works organisation. The purchase of suitable fuel, the classification of fuels, their heating value, the question of feed temperatures, draught, boiler conditions, coal handling, ash handling, ash weighing, gas analysis—in fact, everything pertaining to the boiler house—will be cared for by a department distinct and separate from the engine-house operating department. Such organisation will lead to the best results.

The more general use of mechanical stokers has done a great deal towards improving the boiler-house conditions, inasmuch as the atmosphere has been freed from coal dust, and the underfoot grinding of coal has been largely reduced by the adoption of bunker feed to the coal-hoppers. Further, suction plant for the handling of ashes has made the ash tunnels more healthy to work in, and the general improvement of coal-handling apparatus, wagon tippers, &c., has minimised the necessity for man-handling the coal.

All this is tending in the right direction, but there is a great deal to be done yet before the boiler house is given its proper place in the works organisation. The manufacturers of boiler-house plant and apparatus should look to it that the finish of their products is equal to, or better than, that of plant and apparatus manufactured for use in the engine house. If engineers express the opinion that any rough finish is good enough for the boiler house, how can they expect to induce in their employés that interest in the cleanliness and operation of the plant which is so very

essential? The chimney, because of its architectural beauty (?), receives close attention, and the pointing of the brickwork must be regularly done, but obvious cracks in the walls of the boiler setting for the admission of air remain unattended to. In some places one has to travel about with a duck-lamp to inspect the blow-off cocks of the boilers; even an electric plug position is denied, or was overlooked in scheming out the boiler house, while the engine house is bristling with them.

Even the Board of Trade Inspectors do not seem to notice the unguarded traps which in the engine house and machine shop would immediately attract their attention. Perhaps it is because the boiler house seems to them dark and uninteresting.

The cry for economy in fuel is welcome, although the cause of its coming is to be regretted, for, perhaps, it will be the means of preparing the way for better things, and of clearing away for ever the dark and dusty boiler houses which exist all over the country; perhaps it will be the means of creating a real and lively interest in boiler-house operation, and making the boiler house what it should be—a bright, airy, and clean department of the works, comparing favourably in cleanliness and tidiness with the engine house to which it supplies its product. Then, indeed, will the coal per unit generated be reduced, and brains will be attracted towards the boiler house just as much as they are now attracted towards the engine house. There is a deal to study, a deal to learn, and the reward will be as great as, if not greater than, any which can be earned in any other department of a works organisation.

The high price of coal, and the limited quantity available, make the problem of its economical use more imperative than ever. A thorough reorganisation of boiler-house methods is necessary and essential; for, under present conditions of operation, faults and waste are certainly not as easily detected as equivalent faults and waste would be in the engine house. A leaky blow-off cock hidden away somewhere will not be noticed as quickly as a leaky gland in the engine room; yet it is a condition of wasting fuel. Ill-fitting dampers and a host of other things all spelling fuel wastage are apt to be neglected, simply because of the difficulty of inspection, largely due to faulty lay-out of the plant, or the necessity of climbing over a heap of coal to get at the job. The day will come when the boiler house will be an airy, light, palatial building like the engine house, and scientifically trained men will move about in their work of organisation and inspection, their white jackets testifying to the non-existence of dark and dusty corners, the installation of dust extractors, &c. No longer will gas masks be necessary for ash-tunnel inspections. All will be well in the boiler house, and the ignorant waste of fuel a condition of the past.

COAL CONSERVATION AND ELECTRICAL POWER.

The report of the Coal Conservation Sub-Committee on Electric Power Supply in Great Britain was discussed at a meeting in Newcastle-on-Tyne on April 15th, held under the auspices of the Newcastle Local Section of the Institution of Electrical Engineers. Invitations had been extended to members of the North-East Coast Institution of Engineers and Shipbuilders, North of England Mining and Mechanical Engineers, North of England Branch of the Association of Mining Electrical Engineers, and kindred bodies.

Mr. A. H. Marshall, chairman, said that perhaps the main object in holding that meeting was to obtain publicity for the report of the Coal Conservation Sub-Committee on Electrical Power, which was of such importance generally. The most important matter after the due prosecution of the war was provision for the difficulties which would lie before them when they entered upon the time of reconstruction. They should do whatever they were able to do to develop their resources, and nothing was more likely to prove helpful in this respect than the proposals contained in that report. The suggested economies that might be effected made a striking appeal, and if legislation were to follow, it was necessary they should bring the matter before the public. The financial aspect of the question was an important one, and he thought there were special reasons for the Government giving support to the scheme during construction, for it would increase the productive capacity of the country, and the money so advanced would come back to them in the course of time.

Mr. C. Vernier said one of the greatest problems raised by the war was that of meeting the colossal war debt that would remain at the end. There was only one safe course to follow, and that was to increase the productivity of our industries, trade, and commerce, thus increasing the national income so that we might face the future with equanimity. There must be, too, better relations between employers and employed, and an avoidance of all restriction of output, be the cause what it might. He pointed out that we were nearer the point of exhaustion of our coal supplies than any other important industrial country, and there was something more in the question than the exact amount of coal remaining; there was the further question as to how long we could continue to get it at a reasonable price. Coal prices had advanced by 38 per cent. in 13 years. In view of these facts it was necessary that we should give something more than passing attention to these important matters. With regard to super-power stations, he thought the report was right in recommending private enterprise as more likely to be best in the national interests.

Mr. W. C. Mountain said he did not think anyone would dispute the fact that a general supply of electrical energy at prices which would render its use a commercial advantage to manufacturers and others was highly desirable. It was very important that consumers should not be led to believe that such supply could be obtained within a reasonably short period, thus preventing their making improvements or additions. In connection with various important schemes he had in hand there had been an attempt by officials of the Government to prevent the installation of plant designed to take advantage of existing waste heat, such as exhaust steam and gases from coke ovens and blast furnaces, and it was suggested by these officials that power should be taken from power stations, instead of consumers installing their own plant, notwithstanding the fact that in most cases no power stations existed in the neighbourhood. Such procedure, if insisted upon, would naturally prejudice future progress, and, whilst he would be the last to advocate any scheme being carried out which would involve any expenditure of unnecessary capital, he was convinced from his own experience, that there was a large number of undertakings in this country which could produce electricity at a very much lower cost than it could be either produced or supplied at by any power stations installed for a general supply. There was no suggestion in the report as to the financial aspect of the scheme, and he thought the public should be informed not only of the probable cost, but where it was proposed to obtain the capital, and upon what terms. Also, he thought an indication should be given as to the terms upon which energy was to be supplied. He saw no reason why a flat-rate should not be quoted, with discounts varying in proportion to the consumption. In the report it was stated that the price of current supplied by the Newcastle Electric Supply Co. was under ½d. per unit on the average. That was not borne out by the charges made to consumers in the district with which he was associated. It was true that collieries obtained supplies at low rates somewhat approaching the figure named, but the charges for current for engineering works, shipyards, &c., were considerably higher. In the case of the Park Gate Iron & Steel Co., Ltd., the units generated in six months ended Dec. 31st, 1917, were 3,701,675, cost per unit, .1429d.; and at the Devonshire Works, units generated in the year were 17,500,000, cost per unit .1094d. Surely firms like these would not be forced to take current even at .5d., from a supply company. The report should make it perfectly clear to those in a position to produce their own electrical energy from waste heat, or from other sources, such as inferior coal, that they would not be handicapped or prevented from so producing their own power if they desired to do so. He expected considerable difficulties in dealing with existing power stations, and he thought some indication should be given as to the method of dealing with matters of that kind.

Mr. H. W. Clothier said the "average charge of ½d. per unit" of the Newcastle Supply Co. looked very small, but in their bills they found 3¾d. per unit charged, and now the company was proposing to raise the charges to private consumers by 20 per cent. If it were possible to obtain power at a cheaper rate than a manufacturer could himself make it at, it would pay to scrap less efficient plant, but he thought no business committee would suggest doing that with such plant as Mr. Mountain had instanced. He pointed out that the report did not deal with the cost of transmission, and he also thought something might be done to further research.

Capt. A. H. Law said he thought caution must be exercised at the close of the war, if it came suddenly as was thought by some, to see that they were not rushed into some scheme which was bad from an engineering standpoint. If they kept that thought in mind, and so got the best out of it, he thought the report would do a great deal of good.

Mr. Mark Haliday said that at the Tursdale Colliery, in Durham, a scheme had been adopted whereby the whole of the steam was raised by waste heat from the bee-hive coke ovens. After reconstruction of the plant the fuel costs had come down from £1,300 per month to between £400 and £500 per month, and they were using ballast which before was wasted. That showed what could be done by private firms in the way of economy.

Mr. W. T. MacCall, speaking of the feeling between municipalities and private companies, suggested that perhaps the best way would be to appoint a board for each district. He thought it was a pity there was no proposal to ear-mark a portion of the savings for research work.

Mr. J. R. Andrews, speaking as a private consumer, said he thought one good that might result from those big stations was a uniformity in price for energy.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

MEXICO.—A Decree, dated September 22nd, fixed the export duties on guayule rubber as follows:—

Guayule plants and other india-rubber yielding plants (on rubber contents)	6 p.c. *ad val.*
Guayule rubber	4 p.c. *ad val.*

For the purpose of the Decree, the guayule plant is to be regarded as containing 10 per cent. of rubber. The Minister of Finance is empowered to fix the specific rates which shall rule for quarterly periods for the payment of the duties.

AUSTRALIA.—In reference to the approved form of declaration which is required by the Department of Trade and Customs to be printed or stamped on invoices for goods exported to Australia (see the Electrical Review for December 21st), H.M. Trade Commissioner in the Commonwealth has reported that a composite form has been issued covering both the Invoice Declaration and the Certificate of Origin (which, of course, is still necessary for goods claiming preferential treatment). The date for the enforcement of the new Invoice Declaration does not appear to have been fixed yet.

UNION OF SOUTH AFRICA.—Among recent decisions issued by the Commissioner of Customs as to the classification of various articles under the Union Customs Tariff are the following:—

	Rate of import duty.	Rebate on goods manufactured in the U.K. and reciprocating British Colonies.
Corning conahones (parts of electric or gas lamps, not hand)	3 p.c. *ad val.*	Whole duty.
Electric motor tire pump ...	3 p.c. *ad val.*	Whole duty.
Electromagnets (parts of crane)	3 p.c. *ad val.*	Whole duty.

CUBA.—The President of Cuba has issued a Decree, dated October 4th, providing that certain articles may not be exported or re-exported from the Island except under licence issued by the Treasury Department (Secretaria de Hacienda). The list of goods covered by the prohibition is practically identical with the United States' list.

ARGENTINA.—Two Bills have been laid before the Argentine Congress recently, the first to make provision for certain modifications of the Tariff Law and Customs Regulations, and the second for the constitution of a Committee charged with the duty of revising the Valuation Tariff. (This Tariff determines the values of imported merchandise for the purpose of the assessment of the established *ad valorem* duties.) The proposals contained in the first Bill are mainly directed towards the continuation in force of the temporary additional taxation introduced last year to increase the revenue. Article 13 embodies the proposal (already noted in the Electrical Review for October 26th, 1917) respecting the increase of the Tariff valuations in regard to goods imported without immediate wrappings and packings. Under Article 14 it is proposed that all goods, or produce of any kind, imported or exported, whether subject to duty or free, and those which are cleared in transit for abroad, shall pay the statistical tax at the rate of 3 per mil on the valuations contained in the Customs documents.

As regards the second Bill, it may be mentioned that a project for the revision of the Valuation Tariff, on somewhat similar lines, has been before Congress for some years past, but has not been enacted. Article 3 of the present Bill requires the production of Consular invoices in support of the declared value of such goods as may not be included in the Valuation Tariff. Articles 11 and 12 relate to the periods within which the valuations decided upon become operative, and Article 13 provides that valuations once incorporated in the Tariff shall not be modified for a period of three years, and that six months' notice must be given of any modifications.

NORWAY.—The exportation of dry cells of all kinds, and of lead and alloys thereof in any form, materials, and goods which contain lead or lead alloys in any substantial proportion, has been prohibited. (These are extensions of existing prohibitions.)

PORTUGAL (ANGOLA).—A Decree was promulgated on November 21st providing that, during the continuance of the war, an additional import duty of 10 per cent. *ad valorem* shall be levied at the Custom Houses of the Province of Angola on all merchandise except certain specified foodstuffs.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,327. "Signal devices for motor vehicles." Benjamin Electric, Ltd. April 15th. (U.S.A., June 18th, 1917.)

6,370. "Ignition magneto for internal-combustion engines." A. Santinello, A. L. Wilcken & R. Wilcken. April 15th. (France, April 14th, 1917.)

6,384. "Valves of wireless transmission systems." W. J. Davies, Edison Swan Electric Co. & C. E. Hiatt. April 15th.

6,386. "Automatic telephone exchange system." W. C. Davey & Sterling Telephone & Electric Co. April 15th.

6,388. "Telephones." C. Teasdale Buckell. April 15th.

6,418. "Magnetic friction clutches." W. Langdon-Davies & A. Soames. April 16th.

6,432. "Electric coils." W. H. Exley & H. Leitner. April 16th.

6,453. "Electrically-heated machine for stamping metal articles." J. Bill. April 16th.

6,459. "Electrodes for spark discharges." R. Bosch Akt. Ges. April 16th. (Germany, April 16th, 1917.)

6,466. "Electricity meters." Landis & Gyr Akt. Ges. April 16th. (Switzerland, April 19th, 1917.)

6,517. "Means for rendering absorption by a thermophile, &c., of infra-red radiations audible in a telephone for signalling, &c." L. Bellingham and Bellingham & Stanley. April 17th.

6,524. "Ignition plugs for internal-combustion motors." S. Z. de Ferranti. April 17th.

6,562. "Gas or electric cookers and solid fuel stoves and incinerators working in combination or singly." E. J. Jenkins & A. S. Smith. April 18th.

6,563. "Electric furnaces." H. Etchells, H. A. Greaves & T. H. Watson and Co. April 18th.

6,571. "Contact-breakers for magnetos." P. G. Stickley. April 18th.

6,599. "Synchronous dynamo-electric machines." British Thomson-Houston Co. & R. D. Given. April 18th.

6,611. "Self-acting electric switch." Troup Curtis & Co. and J. H. Wickett. April 18th.

6,629. "Device for locking electric lamps in lampholders." A. H. Marsh. April 19th.

6,641. "Electric switches." G. O. Donovan & W. Donovan. April 19th.

6,657. "Method of mounting electric storage batteries, &c., containing liquids on aircraft, boats, &c., so that none of the liquid shall escape." H. M. Genese. April 19th.

6,659. "Electromagnetic switches." British Thomson-Houston Co. and H. C. Hastings. April 19th.

6,660/1. "Electric furnaces." T. A. D. Lawton. April 19th.

6,672. "Sparking plugs for internal-combustion engines." V. Perrett. April 19th.

6,678. "Working of electric furnaces, and electrode used therein." F. E. Berry. April 19th.

6,679. "Electric relays." W. P. Granville & W. S. Smith. April 19th.

6,682. "Electrically-operated drilling apparatus." H. Scholey & F. K. Woodroffe. April 19th.

6,698. "Electrically-driven hoists." A. Lanz & Veritys, Ltd. April 20th.

6,706. "Protective devices for alternating-current electric systems." A. E. McColl. April 20th.

6,707. "Machine switching telephone exchange systems." L. Polinkowsky and Western Electric Co. April 20th.

6,717. "Magnetos." C. A. Vandervell & Co. April 20th.

6,718. "Magneto electric machines." A. H. Midgley (C. H. Vandervell and Co.). April 20th.

6,724. "Signalling apparatus, &c." J. N. Caught & L. Mayne. April 20th.

6,725. "Machines for making dry-battery parts." D. Barclay & British Ever-Ready Co. April 20th.

6,727. "Glands for electric cables, shafting, &c." W. G. Wheller. April 20th.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1916.

6,406. Ignition Systems for Internal-combustion Engines. C. F. Kettering. August 30th, 1915. (101,334.)

1917.

155. Electromagnetic Regulating and Switching Devices. Electric and Ordnance Accessories Co. & J. Etchells. January 3rd, 1917. (114,320.)

3,419. Electric Signalling Systems. H. Green. March 8th, 1917. (114,325.)

4,228. Electric Generating and Battery-charging Installations for Railway and other Vehicles. J. Stone & Co. and A. H. Darker. March 23rd, 1917. (114,332.)

4,356. Electric Incandescent Lamps and Reflectors used therewith. A. F. Berry. March 26th, 1917. (114,336.)

7,683. Electric Plug Couplings. W. T. Henley's Telegraph Works Co. and W. R. Clements. May 29th, 1917. (114,363.)

8,109. Electric Switches. M. J. Quinn. June 6th, 1917. (114,365.)

8,446. Electric Sparking Plugs. A. A. Scott. June 13th, 1917. (114,368.)

8,992. Rubber-insulated Electric Cables or Conductors. E. A. Bayles and British Insulated & Helsby Cables, Ltd. June 22nd, 1917. (114,373.)

14,206. Metal-plate Structures. Quasi-Arc Co. & W. L. Cole. October 2nd, 1917. (114,394.)

14,455. Electric Pulley Blocks. H. B. Smith & Electric Pulley Block Co. October 6th, 1917. (113,415.)

15,722. Holders or Fittings for the Electrodes of Electric Furnaces. J. R. Hoyle & P. Fawcett. October 29th, 1917. (114,395.)

16,914. Means for Lubricating the Fibre Sleeve of the Interrupting Lever in Magnetos having a Stationary Armature. E. C. R. Marks (Soc. Anon. des Etablissements L. Blériot). December 18th, 1916. (Divided, application on 18,144/16.) (113,586.)

17,044. Electric Motor Meters. Landis & Gyr Akt. Ges. December 2nd, 1916. (111,848.)

17,045. Method of Working Refractory Metals. Westinghouse Metal Filament Lamp Co. (Westinghouse Lamp Co., U.S.A.) November 19th, 1917. (114,282.)

17,874. Process and Means for Connecting Cables or Wires. R. A. Bousson. September 14th, 1917. (114,405.)